

Miniature Work in the Digital Age

Does traditional miniature work have a place in modern productions?

Intro

The aim of my project is to investigate the relevance of miniature work in modern filmmaking, in a digital age where advancements in CGI technology have improved film production by creating more photorealistic and seamless footage between reality and CGI. I will focus my research on determining the relevance, necessity, financial viability and effectiveness of miniature work.

I hypothesise that the use of miniature work in an era of modern effects is still relevant to production, and can be used to create high quality, realistic, seamless footage, using traditional production methods, through the development of a model scenario, implementing design, construction, lighting and other production techniques.

My peers and I will design, construct, light, film and produce a short showcase film, where we can present our separate practical outputs as contributions to the final production. This would allow myself to design, produce and incorporate my miniature model scene into the film.

In my research I plan to interview an industry professional who has specialised experience in miniature production for film, to gather a professional industry insight into the miniature industry.

Film History

The first film was made in (1) 1878 called 'Horse in Motion', which consisted of 12 separate frames depicting a rider on a running horse, and was achieved using 12 separate cameras that would each take a photo in quick succession. Cameras capable of recording moving images were later developed in the 1880's by (2) Louis Le Prince (3), leading to the further development for film and projectors for motion pictures.

However, the birth of modern cinema is attributed to the Lumiere Brothers following the premiere of their film '*The Arrival of a Train at La Ciotat Station*' due to its ability to be distributed to projectionists worldwide and being accessible to the paying public.

In 1897, one of the first wide screen films was shot at the Corbett vs Fitzsimmons Fight, directed by Enoch Rector. Terry Ramsaye commented on the film saying "Until that picture appeared, the social status of the screen had been uncertain. It now became

definitely lowbrow...” which brought the medium from a novelty only available to court rooms, to a much wider appeal.

In the later years of the 19th century, films would continue to evolve, experimenting with different shots, such as the popularisation of close ups and the adaptation of literature onto film. However, in the early 20th century, audiences became bored with repetitive cinema, resulting in filmmakers undergoing a period of further experimentation and technical development, including sound, lighting, and special effects.

The first known special effects film was released by (4) the Lumiere brothers released in 1895. One of the biggest innovators of special effects in film was Georges Melies, who pioneered in methods used throughout the century. He is famous for his film *‘Indian Rubber Head’*, which shows himself in the film making a head expand (also played by Melies), but is most remembered for *‘Trip to the moon’* due to its mixture paintings, prosthetics, miniatures and shifting false landscapes effects. In 1916, Frank Williams was one of the first to experiment with effects compositing actors into a scene by filming them against a black background and then filming a new background later on.

1920s

However, there was a boom in the use of special effects in the 1920s as studios used it to bring in audiences. With evolving equipment, the use of miniatures was introduced to depict scenes and landscapes that were too big to be built in full scale. Miniatures were also used to save money, which further encouraged their use in cinema.

Films also combined full scale sets with miniature models to save on construction. This was done by building the lower half of the set at full scale, then placing the miniature close to the camera, giving the effect of a full-scale building. An example of this would be *‘Dorothy Vernon of Haddon Hall’* (1924), where the lower half of a castle and small tower was constructed using simple box shaped segments. The top of the castle was then constructed as a miniature, and placed close to the camera, giving the impression of a complete castle on film.

In the 1920s, the use of miniatures for sets was not just used in Hollywood. It was generally considered the Germans were more technically advanced in their special effects departments, their greatest special effects were created by their biggest studio, the Universum Film AG (UFA). Their most famous known work was *‘Metropolis’*(1927), which incorporated effects such as rear projection, matte painting, and the Schüfftan effect, which uses holes in mirrors to combine miniatures and sets. However, by the 1930s the best directors and technicians had all moved to America.

1930s

Rear projection became a popular method for putting actors in location during the 1930s as opposed to using traveling mattes. Whereas a traveling matte (5) involves an image of the actor being cut out by hand from each individual film frame, allowing an alternative background to be added in, rear projection created scenery effects cheaply, reduced manual labour and a faster production technique.

1940s

The 1940s brought around the use of colour film, but this was not adopted as quickly as sound, with the first live action film to use colour film was '*Becky Sharp*' in 1935.

'*Citizen Kane*' was released in 1941 which heavily used miniatures, matte paintings, optical printing and animation. However, it was not nominated for special effects in the Academy awards.

During the Second World War, Hollywood's output focused on boosting morale of soldiers and civilians. The studios created miniatures, to depict battles and ships in realistic environments. An example of miniature ships being used with water is '*Thirty Seconds over Tokyo*' and '*Ships with Wings*'. Aerial combat was also depicted using miniatures, with an example being '*Mrs Miniver*' in 1942.

Alfred Hitchcock was prone to subtly using special effects in his films, for example, in '*The 39 Steps*' in 1935 and '*The Lady Vanishes*' in 1938. He also worked on '*Foreign Correspondent*' in 1940, '*Rebecca*' in 1940, '*Lifeboat*' in 1944, '*Rope*' in 1948, and relied more on effects in '*The Birds*' in 1963.

1950s

Due to affordability people switched from cinema to TV, and the amount of people going to the cinema (4) "plummeted from around 90 million in 1948 to 51 million in 1952" (page 28). This caused studios to develop higher quality images, colour films, and larger screen, which was meant to combat the small, low-quality image of TV at the time. There was a development in 3D technology and was used in films such as: '*Bwana Devil*' (1952), '*Kiss Me Kate*' (1953), '*Dial M for Murder*' (1954), '*House of Wax*' (1953), and '*Hondo*' (1953).

The 1950s also experienced a rise in science fiction films, the first big budget science fiction film was '*Destination Moon*' (1950) produced by George Pal, who would later go on to produce other high quality special effects films such as '*When Worlds Collide*' (1959), '*War of The Worlds*' (1953), '*Conquest of Space*' (1955), and '*The Time Machine*' in 1960. Sci-fi films resulted from the popularity of sci-fi books and comics, and the fears of the cold war, as films at the time often depicted advanced aliens being violent towards people with advanced warfare technology.

Another notable film from this decade for its special effects was '*The Seventh Adventure of Sinbad*' (1959), which used a combination of perspective tricks, split screens, mattes and stop motion animation. This decade also saw further development in moving mattes in Britain, which were then adopted and further developed at Disney.

1960s

Film productions in the 1960s became enormously large and expensive, as studios built full scale sets. An example of this is '*Cleopatra*' (1963) which had 10,000 extras, full scale palaces, and a real floating barge. However, this film failed to make back the money it took to make and almost bankrupted the studio Fox.

As studios preferred shooting on location, built full scale sets, and used real stunts, most studios diminished their special effects departments, with Disney being the only studio to keep a full-time special effects department was Disney, producing family fantasy films, such as '*The Nutty Professor*' (1963) and '*Mary Poppins*' (1964). This shortage resulted in an increase in independent special effects studios, resulting in the loss of knowledge and skills from an entire generation.

However, in 1968, Stanley Kubrick would release '*2001: A Space Odyssey*' which would involve enormous model space stations and space craft, which were shot using an early form of motion control. Kubrick used front projection, giving the image a brighter and more defined quality and saw the invention of a method called 'slit scan', which was used for the films psychedelic sequence. The only major developments in special effects during this decade were because of this film.

1970s

As studios didn't know why '*2001: A Space Odyssey*' was popular, they were unable to capitalise and exploit it. However, similar special effects films developed, such as '*Journey to the Far Side of the Sun*' (1969).

Disaster films became popular in the early 1970s, including blockbusters such as '*Airport*' (1970), '*Poseidon Adventure*' (1972), '*The Towering Inferno*' (1974), '*Earthquake*' (1974), and '*The Hindenburg*' (1975). Although brief, this trend would give the underemployed special effects industry temporary work.

Aimed on making money, young film makers were employed to introduce a new generation of film, including directors Steven Spielberg, George Lucas, and Francis Ford Coppola, making their cinematic hit films '*The Godfather*' (1972), '*American Graffiti*' (1973) and '*Jaws*' (1975), '*Jaws*' being a leader in the use of special effects.

In 1977, inspired by '*2001: A Space Odyssey*' George Lucas produced '*Star Wars*' (1977) which was more excitement and fast paced, full of fast paced dogfights set in space. Its biggest special effects innovation was its motion control, and being able to repeat fast paced and complicated movements. But '*Star Wars*' (1977) also incorporated matte paintings, miniature models, optical effects, make up and stop motion animation.

In 1977 Steven Spielberg also released '*Close Encounters of the Third Kind*' (1977) which similarly to '*Star Wars*' also relied on special effects including, matte paintings, miniature models, optical effects, puppets, and stop motion animation.

Due to the success of '*Star Wars* (1977) and '*Close Encounters of the Third Kind*' (1977) studios rebuilt their special effects departments, hiring new and retired special effects artists, returning the skills and knowledge previously lost to a generation. Some major films produced during this period include: '*Superman*' (1978), '*Star Trek: The Motion Picture*' (1979), '*The Black Hole*' (1979), and '*Alien*' (1979).

1980s

The 1980s popularised home videos and studios soon realised they could release old and new films on home video, giving films a longer shelf life after their theatrical run. This caused studios to have (4) "100 major releases annually, compared with 350 in the 40s" as they cater to a younger audience with action, violence and special effects. Some examples are '*Flash Gordon*' (1980), '*Blade Runner*' (1988), and '*E.T. the Extra-Terrestrial*' (1982).

This decade saw a big emphasis on films with (4) "comedy, action and spectacle" with spectacle, these included films such as '*Ghostbusters*' (1984), '*Back to The Future*' (1985), '*Lethal Weapon*' (1987), '*Die Hard*' (1988) '*Indiana Jones Trilogy*' (1981, 1984, 1989), which often contained miniatures and special effects.

Films became increasingly expensive to produce costing an average of \$10 million in 1980, and much of this was due to the reliance and audience expectations of special effects. There were many special effects companies during this time, but the most influential and successful was Industrial Light and Magic (ILM), which was originally established to produce '*Star Wars*'. This was a very stable, prosperous and innovative time for the special effects industry due to the amount of companies specialising in this one area.

One of the biggest developments came from Disney's '*Tron*' (1982) which combined live action actors and fully digital world, with sequences of completely computer-generated imagery (CGI). Although it failed financially, CGI continued to develop, with films such as '*Star Trek II: The Wrath of Khan*' (1982) and '*The Last Starfighter*' (1984).

1990s

The 1990s continued the development of CGI due to the increasing power and speed of computers, and advancements made in digital scanning technology, allowing physical objects to be brought into the digital format. Some examples are (6) '*Terminator 2*' (1992) and '*Jurassic Park*' (1993) which had fully CGI dinosaurs. Then in 1995 '*Toy Story*' (1995) was the first completely computer animated film. More fully CGI films would later follow, one of these being Disney/Pixars '*A Bug's Life*' (1998),

George Lucas would release '*Star Wars: Episode I The Phantom Menace*' (1999) which implemented the previous advancements in CGI, but he would also use aspects of digital film making. This would show the power and capabilities of digital film making over analogue film, showing creatives and directors the ability to create anything they want on film.

DVDs were introduced in 1996, which was quickly adopted by 40 million people within 5 years. This led to a very profitable time for the studios, as audiences were spending \$20 billion annually on at home cinema entertainment.

2000s

The 2000s saw the development of CGI increase significantly, over-taking the usage of practically made special effects, effects were now chosen on how fast and cheap they could be developed.

The biggest digital special effects companies would do more technically advanced and expensive CGI shots and developing their own technology, while employing hundreds of people. Medium sized companies would use off the shelf technology to assist the major companies or produce CGI shots for smaller productions, while only hiring 100 to 50 people. The smallest companies, known as boutique companies, made up of a hand full of people, do smaller work on productions, such as removing wires from a stunt scene.

While films were relying ever more on CGI, there were larger productions that would combine the detail and realism of miniatures with the digital medium. An example is '*The Lord Of The Rings*' trilogy, which saw miniature set pieces being filmed on a moving camera rigs and added into the digital world. Doing this would allow the scene to

maintain detail, while placing the miniature model set pieces into the digitally enhanced world and sometimes to composite the miniatures into real camera footage.

(7) '*Harry Potter and the Philosopher's Stone*' (2001) (8) used miniatures which were then filmed and enhanced with CGI or incorporated into a digitally made world. However, (9) the later films in the franchise used CGI instead of miniatures, marking an industry shift to CGI. A popular example would be (10) '*Iron Man*' (2008), which used (11) "over 400 shots" with CGI.

Jose Granell Interview

(1) Before undertaking this interview I felt confident that there would be a future for miniatures in modern film making, with films like (2) '*Blade Runner 2049*' (2017), (3) '*Asteroid city*' (2023) and (4) '*The Mandalorian*' series making use of miniatures during select sequences. However after getting such a reliable industry insight, I am currently less sure about my original hypothesis, as there are less projects using miniatures, less opportunities for new people to gain experience in the industry, and the threat of AI to computer graphics, all of which I will get to shortly.

Jose Granell is most well-known for his work on (5) the '*Harry Potter*' films, '*Charlie and the Chocolate Factory*' (2005), '*Batman*' (1989), and '*V for Vendetta*' (2005) and over 40 years' experience in the miniature industry. Working with on films with directors such as Guillermo Del Toro for (6) '*Frankenstein*' (2025) and (7) '*Charlie and the Chocolate Factory*' (2005) directed by Tim Burton, along with (8) Chris Columbus, (9) Alfonso Cuarón, (10) Mike Newell, and (11) David Yates for the '*Harry Potter*' films.

The main points that swayed the opinion of my hypothesis is the diminished amount of work involving miniatures, the rise of AI, and the lack of opportunities for the newer generation, which I will now cover.

During the interview I asked Granell on his opinion on how he thinks practical models will adapt in the future, to which he answers "I've just been out to LA where we were in the bake off for the academy for our work '*Frankenstein*' (2025), and now there's an example where you've got an incredibly creative director who's very passionate about craft, and the same with Dennis Berardi, the visual effects supervisors, they wanted to employ all the tools, if you like, rather than just a digital tool to everything."

He then adds "There's still a few people out there who understand the benefits... when I was in LA I spoke to two of the other visual effects supervisors who were involved in the [*'Frankenstein*' (2025)] project with us... I asked them how they felt about miniatures and neither of them really had direct, sort of contact on any film with miniatures and they were actually very surprised how great it was, how beneficial it was."

Although this tells us that miniatures can still be and were used as a tool in visual effects, I get the impression that it is rarely used. This came from the line "neither of them really had direct, sort of contact on any film with miniatures", which comes from the special effects supervisors for a film that has (12) currently won three Oscars and with (13) 29.1 million views on Netflix in its first three days, which makes it "the streamer's fifth biggest film debut of 2025" Over all this means the people working on special effects for one of the biggest films of 2025, have had little to no experience working with miniatures, implying how scarce miniature scale models are used in modern filmmaking.

But I think the most important aspect of the response to this question is "but I think to be honest with you it's inevitable that the writings on the wall, and it's not just for my world, AI is creeping in and we won't be able to stop it... for financial reasons it will work its way in and it won't just be my world but it will also be digital artists because they just won't need so many people involved anymore."

To which I then asked about the similarities between CGI influencing the amount of work that model makers get, compared to with AI influencing the amount of work digital artists get, in which Granell answered "I think it's a great shame but it's quite nice to see them have a little bit of the medicine. We've suffered for years, you know we probably lost 90 plus percent of our work since in the last 15 years... It's a shame because I get so many young people who contact me on a weekly basis... but I sort of

try and encourage them to go and find other stuff because I think it would be irresponsible of me to encourage them to come and train up as model makers when they might only get two or three years of a career out of it.”

When comparing these last two quotes, I get the impression that CG is responsible for taking work away from the miniature industry, coming from the line "to see them have a little bit of the medicine" which refers to AI taking work from digital artists, mirroring how the CG industry greatly diminished the scale of the miniature industry. I feel the fact that AI taking work away from digital artists has made me realise how far the film industry has moved away from miniatures. As the medium that replaced using miniature effects is now getting replaced itself, which has greatly effected how I view my hypothesis.

To consider this fact with my hypothesis of “miniature work in an era of modern effects is still relevant to production,” we must first defy the meaning of ‘relevant’. The oxford dictionary defines the word as “closely connected with the subject you are discussing or the situation you are thinking about” and “having ideas that are valuable and useful to people in their lives and work”, while Merriam Webster defines ‘relevant’ as “relating in an appropriate way to something under consideration : having significant and demonstrable bearing on or relation to the matter at hand”. This means that for something to be ‘relevant’ it must be properly considered to be appropriate, valuable and useful for the situation at hand.

I think the previous quote of “the visual effects supervisors, they wanted to employ all the tools, if you like, rather than just a digital tool to everything.” implies that under certain circumstances and under people who “employ all the tools” then the use of miniatures would be relevant and was relevant for ‘*Frankenstein*’ (2025) which the quotes are in context to, however it is currently unclear to say if this applies for the industry as a whole.

When asked about the timeframe in which their workload was effected, Granell responded with “When we first noticed it, it was when we did ‘*Lost in Space*’ (1998)... we got involved with CG ourselves, but it was such a growing thing that you literally, you could spend tens of thousands on software, then 18 months later you couldn’t even give it away, the evolution was so fast.” this implies that the effects of CGI came into effect in the late 1990s, being earlier than originally thought.

Castle Research Intro

During this project, my peers and I will aim to produce a short film, and I will build a miniature for the establishing shot. I will also do the lighting and camera work to keep them consistent between the interior, exterior and model shot.

We decided to set our film within a medieval setting, between (3) 1066 and 1154, as the set designer is focusing on historical accuracy. To increase the believability of my model on screen, I will need to make sure my design mirrors real castle architecture, to look and feel it belongs within the world of the film.

To create a visual link between the full-scale set and my miniature, I will take the shape and design of the window from the set, and incorporate it into my model. I feel that this would allow the audience to make a visual connection between the two, understand where the story is taking place.

Books, (1), (2), (3), (4), (5), (6), (7), (8), (9), (10). (1), (2), (3), (4), (5), (6), (7), (8), (9), (10). These are books and websites I read that gave me inspiration for this research and miniature

Castle Research

(1) (P4) Castles were built on mounds, also called a “bailey”, which gave the castle a greater view of the surrounding area. (2) Castles were originally made from timber, but were later made from stone for its strength and fire resistance. (P39) A keep is a square or rectangular building which was the a main feature of castles built in the Norman period (3) which took place between 1066 to 1154. However, keeps took on a circular shape in the thirteenth century, which were often smaller than their earlier counterparts. As Norman keeps were built from stone, the mounds they were built on had to have a much larger summits to support the weight of the stone. (P40) Norman keeps have been found to be as small as 9.5 x 10.5m, in a trapezoidal shape, but there have been square keeps found as small as 10.7m squared. (4) But the largest keep built during the Norman period was in Colchester Castle which “measures 46 by 33.5 metres”. (5) But the tallest Norman keep was Rochester Castle, which is 35m tall, with a layout of 22m squared.

(6) Due to castles during the Norman period being made from stone, they were often coated with “non-hydraulic lime”, which although had the tendency to weather easily, the quality of the plaster saw a great increase in quality during this period, due its high demand. (7) Plastering the exteriors of buildings gave them a natural white look. The

photo below shows a sample of non-hydraulic lime plaster, which shows its white tint. We can also see from this photo that the plaster seems to have a rough texture.



To work out the height of each floor (8) I will use this side view of London tower as it has clear indications on the exterior for the heights of the rooms. I will measure the height of London tower using the image below and divide it by the height of the rooms shown on the exterior. I will be using the row of windows above the ramp entrance as my room height reference as it shows a dividing line below the ground and first floor that gives me a rough estimate of the height of the floor, and then I will be using the arches above the row of windows as arches were often used for ceilings do to their structural abilities. (10) as the height of tower of London is “27.4 meters”



going off of the height of the set Imogen in building for the IP film, I will be having the floor to ceiling height at 3m and the floor width at 1m.

(11) A merlon is a protective feature on top of a defensive structure, like a castle, that allows for greater protection while leaving gaps that allow weapons to be used by the defensive side. A merlon typically measures "4-5 ft wide and 3-7 ft high" (1.2-1.5m wide and 0.9m-2.1m high) with a 2-3ft (0.6-0.9m) gap between each merlon. So a 10m wide keep with 1.2m wide merlons, spread 0.6m apart, would be:

$$1.2+0.6=1.8$$

$$10/1.8=5.5$$

$$5.5 - 0.6=4.9$$

However as this is more of a rough guide, I will be rounding up the number from 4.9 to 5, meaning we would 5 merlons(1.2 wide and 0.6 apart) on a 10m wide castle.

Material Research

(1) To create your own brick work you can use foam board, you can then use a sharp scalpel or craft knife to carve out horizontal and long vertical lines into the mount board, in your chosen pattern of bricks. To keep the scale and strength of the model, only cut about one third of the materials thickness. When done correctly, this will imitate the mortar between the bricks. After the bricks have been carved, give the foam board a coat of black spray paint to accentuate the bricks and details. However (P24) aerosol paints and glues will damage the foam in the foam board and should not be used.

Epoxy-filler Brickwork

This method is very similar to the way brick tiles are made in scenic art, which involves using masking tape to create the mortar gaps and using epoxy filler to miniature the bricks.

(2) (P15) There is also a method which involves using glass paper as brick texture, cutting out the individual brick shapes and applying them to a surface.

The materials I will be using are:

- 1 inch thick A4 foam x 1
- A2 Mountboard x 6
- Multipurpose plaster
- Reused wooden planks from recycled flat and workshop scraps
- Wood glue
- Pin hinge (GET PROPER NAME)
- Staples (GET PROPER NAME)

Mount Board

Through my research and time at university, I have found that mountboard is often used in (3) model making as a structural material for model making, (4) due to its low cost and strength. Due to my limited budget and some pre-existing experience with mountboard, I will be using this as the main structure for my model.

Due to the size of the model being 1 meter by 1.1 meter on each side, and the biggest size of mountboard I could purchase in person being A2 (5) I would have to combine multiple pieces of mountboard together. To do this, I had to do some maths to work out the area I would need to cover, then the area each size sheet would cover and how many I would need.

Mountboard area maths:

Area needed to cover the model: $1100 \times 2000\text{M} = 2,200,000^2 \text{ mm}$

A2 area: $420 \times 594 = 249,480^2 \text{ mm}$

$2,200,000^2 / 249,480^2 = 8.8$ (rounded up = 9)

A1 area: $594 \times 841 = 499,554^2 \text{ mm}$

$2,200,000^2 / 499,554^2 = 4.4$ (rounded up = 5)

A0 area: $841 \times 1,189 = 999,949^2 \text{ mm}$

$2,200,000^2 / 999,949^2 = 2.2$ (rounded up = 3)

As I am only able to buy pieces in full, I had to round the numbers up to cover the required amount. So to cover the required area of the model I would need to buy either 9 pieces of A2, 5 pieces of A1 or 3 pieces A0. When considering the price, availability, and where I can buy them in person (as to cut down waiting times), I decided to buy 6 pieces of A1 due to it being the biggest size I could easily buy and being relatively inexpensive. However I decided to buy 6 pieces rather than 5, to make sure I had enough if I were to miscalculate.

Foam Board

As I would like to have brick textures that will be visible in areas of the model without plaster, to give it a worn down and more visually interesting look, (6) I will be using foam board to cut out my bricks. The reason for using foam board is due to its easy to use properties that will allow me to easily carve it into the desired shape. I ended up purchasing a 1 inch thick A4 piece of foam from my local Hobby Craft, as it was the correct material and was the right size where I would be able to get enough bricks to fill the space I need, while also not leaving too much excess.

Plaster

During my research I found that the best material to represent plaster is plaster, I was a little unsure in the different kinds of plasters to use for my model as my source referred to the plaster at (7) "normal plaster" which does not give me enough information. To cover this I decided to go for (8) a multi finish plaster, as it is easy to use, dries quickly, and it is suitable for use on a wide range of materials.

To help the plaster stick to the mountboard, I will also be adding (9) PVA to the mixture as this will help the plaster to better stick to the surface and increase the durability of the model.

Contact Adhesive

I will be using contact adhesive to stick the two materials together. I have chosen to use contact adhesive as it is (10) quick drying, bonds strongly between the two surfaces and is able to work on a wide range of materials (11) including foam.

Filming Location Options

During my research I have found that full scale sets were combined with scale models to produce a scene for the audience that effortlessly blend the set and model to produce a singular scene.

As I do not have the time, money or skill sets to build part of a castle at full scale, as of this I will be using pre-existing castle ruins to incorporate my scale model into footage taken of these castles.

I would like the film shot to have a castle on a mountain with mountains in the distance, be easy to access to access and to bring filming equipment to, free of charge to enter, and to be within an hour driving distance from my house.

To start searching I used google maps to search for castles within south Wales and pick out ones that I thought would be easy to access and that I thought was aesthetically pleasing.

I had a final list of eleven castles that fit my design requirements. These castles are:



(1) Coety Castle, Bridgend.



(2) Ogmore Castle, Bridgend.



(3) Pennard Castle, Mumbles.



(4) Castle Oxwich, Gower



(5) Castell Dryslwyn, Carmarthen.

Really like the look of this one. On a protruding hill, nice amount of flat walls still standing. (6) Built in 13th century, so a century too late but I will discuss this in the next meeting



(7) Carreg Cennen Castle, Llandeilo

While I like the aesthetics, this castle was(8) built in the 13th century so is out of my time frame.



(8) Kidwelly Castle, Kidwelly

There is an admission fee of £8.50, this location may be too built up to set up and film.



(9) Carew Castle, Carew

While this castle is aesthetically pleasing, it is not on a tall enough mountain and it is too far for me to get to, as I have travelled to this location which has an entry fee and staff members present.



(10) Pembroke Castle, Pembroke

Much like Carew Castle, I do not think this castle is on a tall enough hill to give me the image I want and I also think it is again too far away to justify using this castle specifically.



(11) Castell Llansteffan Castle, Carmarthen.



(12) Castell Dinefwr, Carmarthen.

After reviewing my options, I narrowed down the castles I would like to location scout to Castell Dinefwr, Carreg Cennen Castle, and Castell Dryslwyn. As they were the most in line with the image I wanted, they were about 20 minutes east of Carmarthen which made them within my desired distance and they were all relatively close to each other, allowing me to easily conduct a site visit day without making multiple trips.

The first castle I went to was Dryslwyn Castle which I found was easy to access, with a clear path going up the hill, with steps and hand railings along the path, along with a free car park at the bottom of the hill.

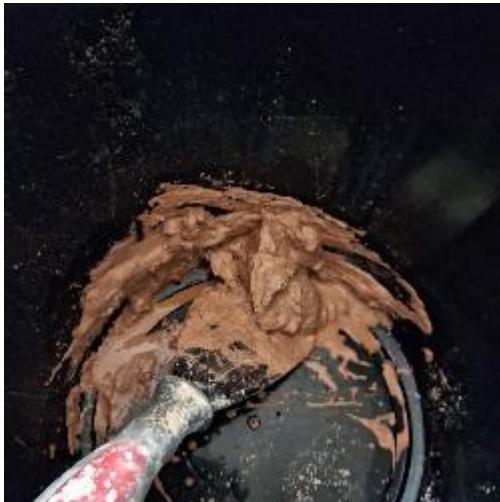
While I was scouting this location, it was very windy and rained a little bit, which although I thought would make the location unfit, this is an issue that I would have with most locations if I wanted the castle to be on a hill or a mountain. As of this I would have to plan my filming days in line with weather more suitable for filming.

After measuring the dimensions of some of the bricks and taking some photos of the castle and location. I decided that I would cut the location scouting day short as the weather conditions were not ideal. After some consideration, I decided this location was right for the job as it was easy to access, in line with my desired image, free entry and without staff members.

Filming days

After I had chosen the location, I set out on arranging a filming schedule, which included factoring in elements such as my availability, booking and borrowing equipment, and the weather. I chose the 2/2/26 as my filming date as I was available, able to pick up equipment, and the weather was correct for the look I wanted.

Testing



Before plastering the full model, I wanted to run some small tests to determine the best methods for plastering, and plastering on mountboard. During this test I will be testing out the mixtures of PVA with the plaster and finding the best method in terms of how well the plaster sticks to the mountboard, how easy the process was, and the cost. I would be having 4 test pieces varying in the way the PVA was used. As seen in the photos above, I also used this chance to get an understanding of getting the thickness of the plaster, which should be somewhere between not too watery and not too thick. These test pieces were:

- PVA in the plaster and on the mountboard
- PVA in the plaster and none on the mountboard
- No PVA in the plaster and PVA on the mountboard
- No PVA in the plaster and none on the mountboard

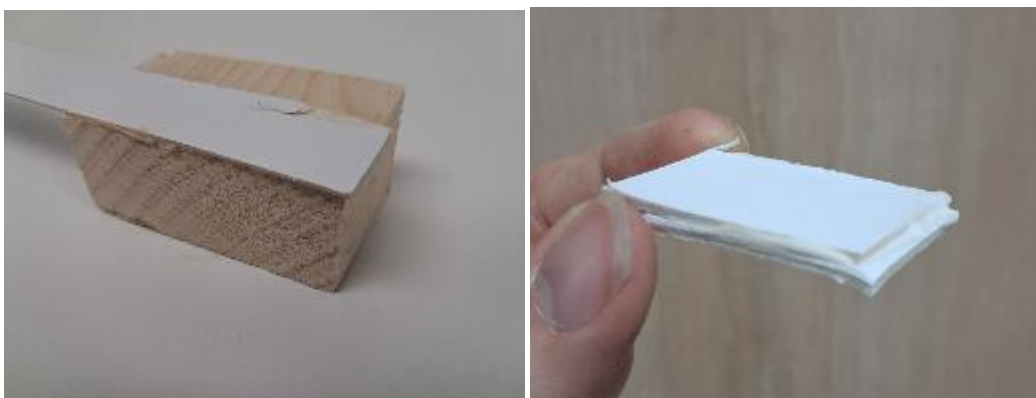


As seen in the photos above, I used this opportunity to understand how to apply the plaster to the mountboard and finding out how to achieve different looks and textures on the surface. I like the look of the top and bottom photos on the right as they have more rough textures which will be able to be seen from a distance on the camera will be filming with.



After the plaster had dried, which took about 1 to 2 days to fully dry, I tested the samples to see how easily the plaster would crumble when bent, but I found that all of the samples showed very good results, as although all the surfaces cracked when bent, none of the plaster fell off any of the samples. As of this I will be using the most cost and time effective method, which uses no PVA for the plaster mixture or the surface.

I went ahead and primed the plaster by adding coats of watered down acrylic paint, which allowed the paint to better stick to the surface. This would allow me to get an idea on how thick the primer should be to achieve the desired colour I am looking for. I used titanium white on all the samples but also used a pearl white on the far left sample just to get an idea how it would look, however I will not be using pearl white as I find it makes the surface look too metallic and it too shinny. As of this I will be using a matte white paint for the surface. I also found that I had to use multiple coats of primer to achieve something close to the colour I was looking for, so while initially I will have to use a more watered down coat to stick to the plaster, I will need to use thicker coats later on. The middle left sample is the closest.



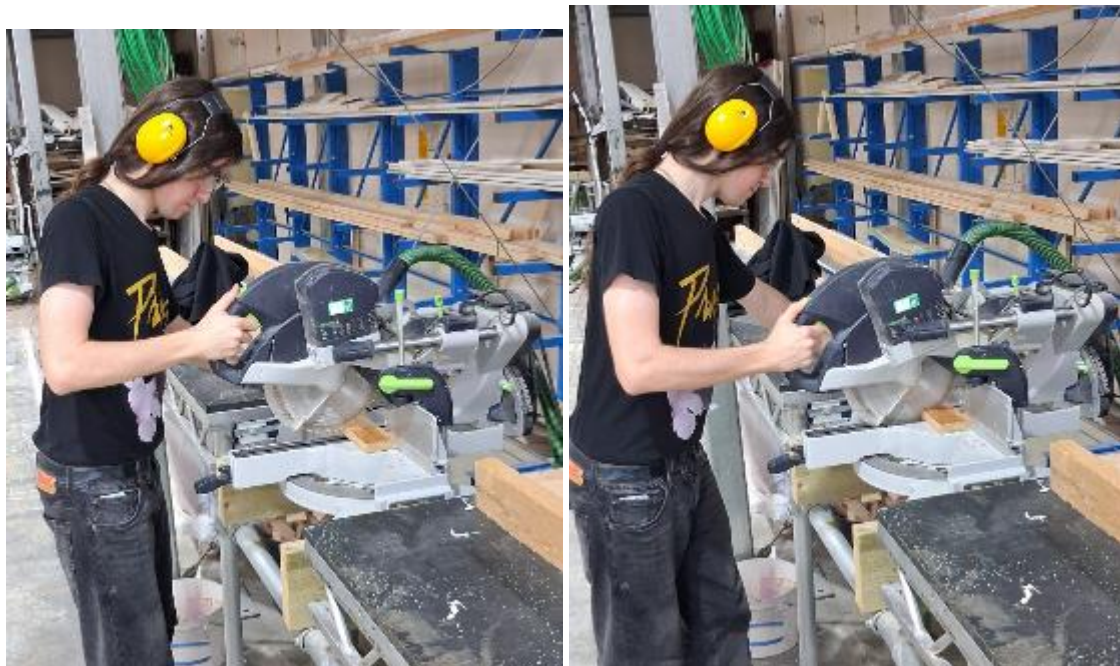
During this building process I will be attaching the mountboard as cladding to a wooden frame, but before I did I wanted to make sure how the mountboard would react to the wood glue, which was easily accessible in the workshop. After some quick tests, I found that the mountboard was able to securely attach to wood and other pieces of

mountboard in a relatively short amount of time (30-60 minutes) when glued and clamped together.

Frame building



As I wanted to save on budget and waiting times for deliveries, I decided to repurpose a half dismantled flat that we had previously built and used for another set, and that was already missing most of its cladding. This was a very tedious task that involved me sanding down rough edges, chiselling off excess wood glue, removing loose nails and paint, so I would have a clean and usable surface to build my frame from. This left me with 2 pieces of 3000 X 65 X 20mm and 3 Pieces of 1180 X 65 X 20mm.



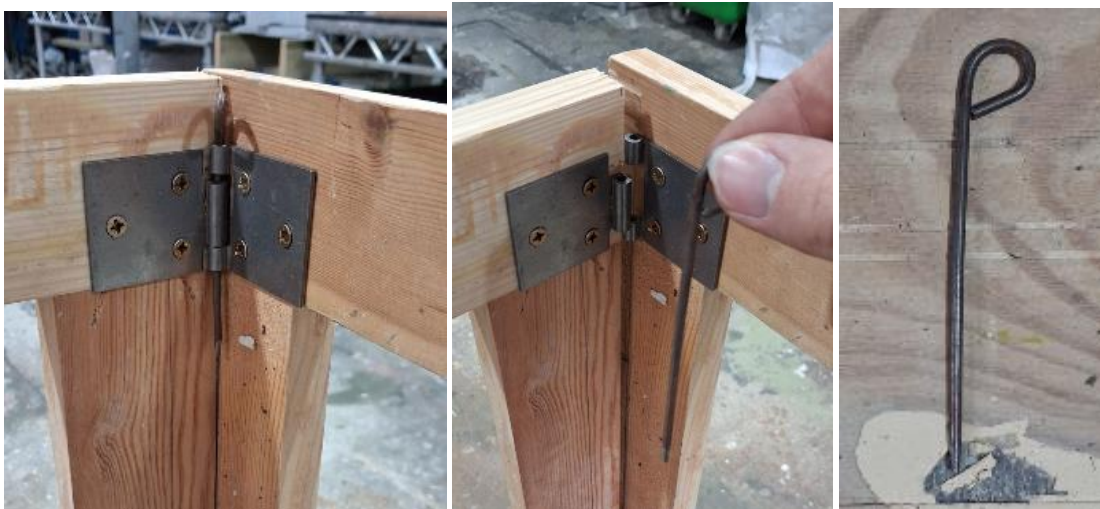
After this I then had to cut the reused wood into the correct sizes, which I simply did by using a chop saw, as it was quick and left the wood in clean cuts. I cut the sizes down into 4 pieces of 1100 X 65 X 20mm, 2 pieces of 870 X 65 X 20mm and 2 pieces of 850 X 65 X 20mm.



After the wood was cut to the correct length, I then glued and stapled the pieces together. I decided to face the width of the planks out, as this would allow me to easily attach the pin hinges in a way that would allow the frames to seamlessly line up. I have also made a beam that will attach to the flats diagonally which will not only keep the flats square, but allow for extra weights to be added to help keep the model from tipping over. This beam will be screwed into the back of the model to allow it to be deconstructed and stored easily.

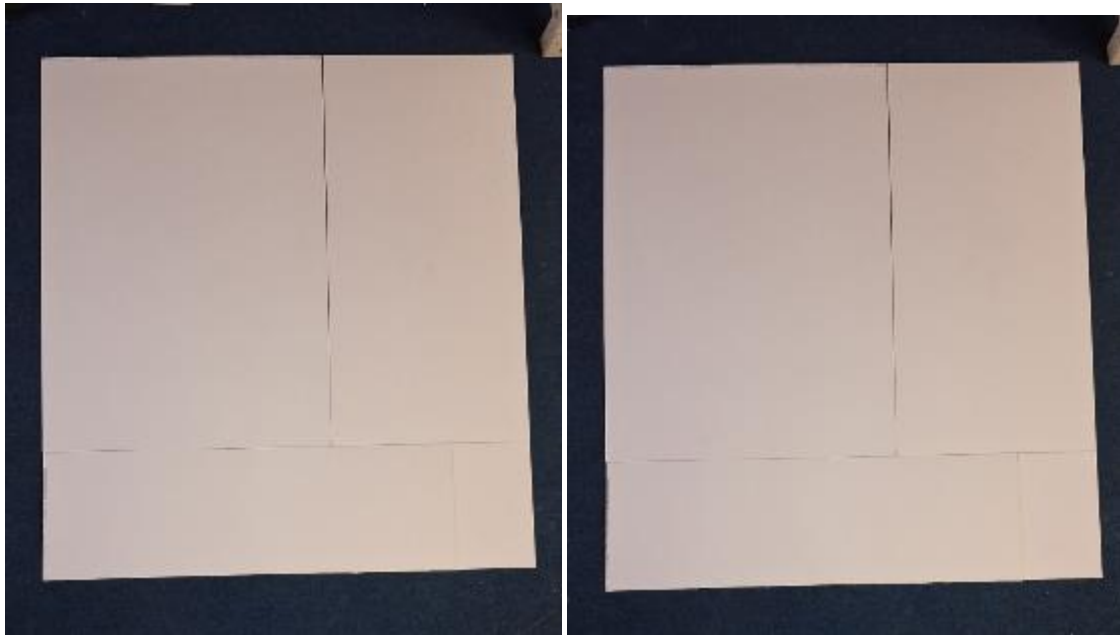


To staple the planks together, I used (1) corrugated fasteners as they “create strong connections between wood pieces quickly” while keeping the wood from slipping from the staple, due to the curved properties of the staple.



To connect the two frames together I decided to use (2) pin hinges, as they allow me to securely hold the two frames together, while being quick and easy to disassemble which you can do by simply removing the pin. While there are no permanent connections between the pin and the hinge, there was some friction from the alignment of the flats, which further strengthened the connection point, without reducing the ease of dismantling.

Cladding



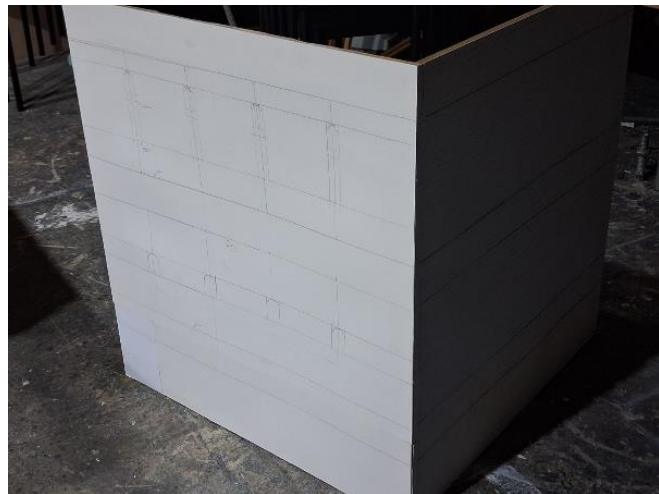
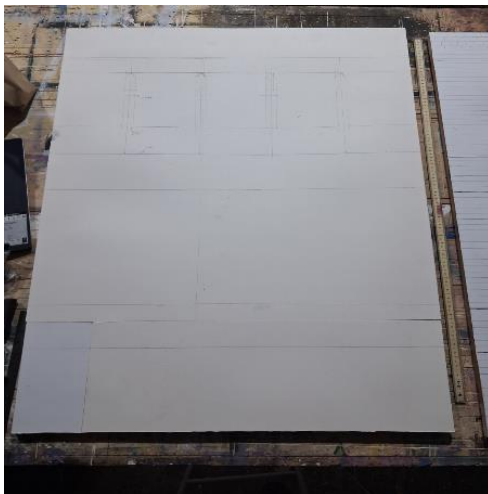
Using the 6 pieces of A1 mountboard, I cut them up into different sized boards which I then placed together to create a 1 X 1.1m rectangle. I started off placing two of the A1 cards next to each other on the floor, then measuring 1m across from the left, and then cut the board length wise, which then gave me the full width of the model when put next to each other. I then used the left over mountboard to give me the correct height of the model, which left me with lots of excess mountboard and an entire board to spare.



After the mountboard was cut to size, I then stuck them to the frames using wood glue, which I had previously tested. To make sure the mountboard was securely stuck to the frame, I made sure to clamp the frame to the table, with the mountboard in between, with weights on the areas I was unable to clamp.



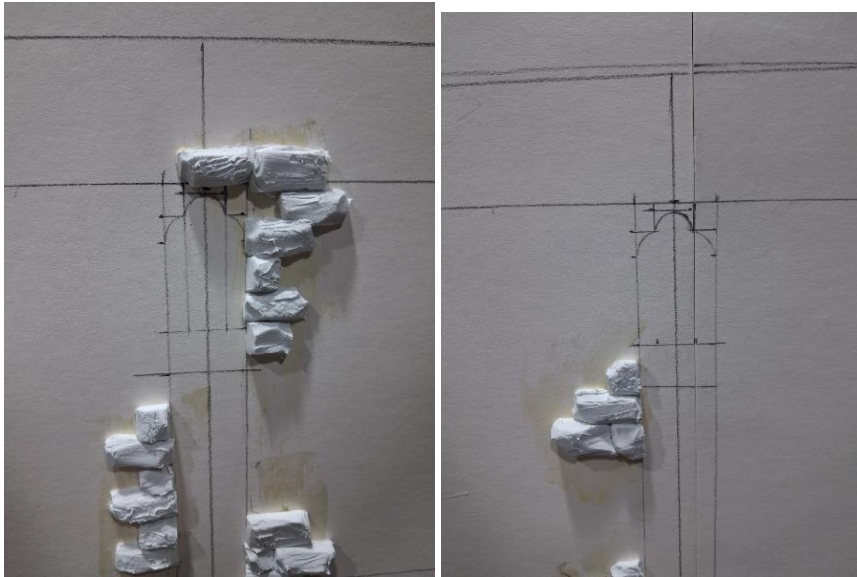
After the glue had set, I then used the previous excess mountboard to help hold the mountboard pieces together, which would keep the boards from moving separately and further increase the strength of the model. You can also see in the photos above, that I also cladded the side of the right frame, as this side will be visible and will need be plastered.



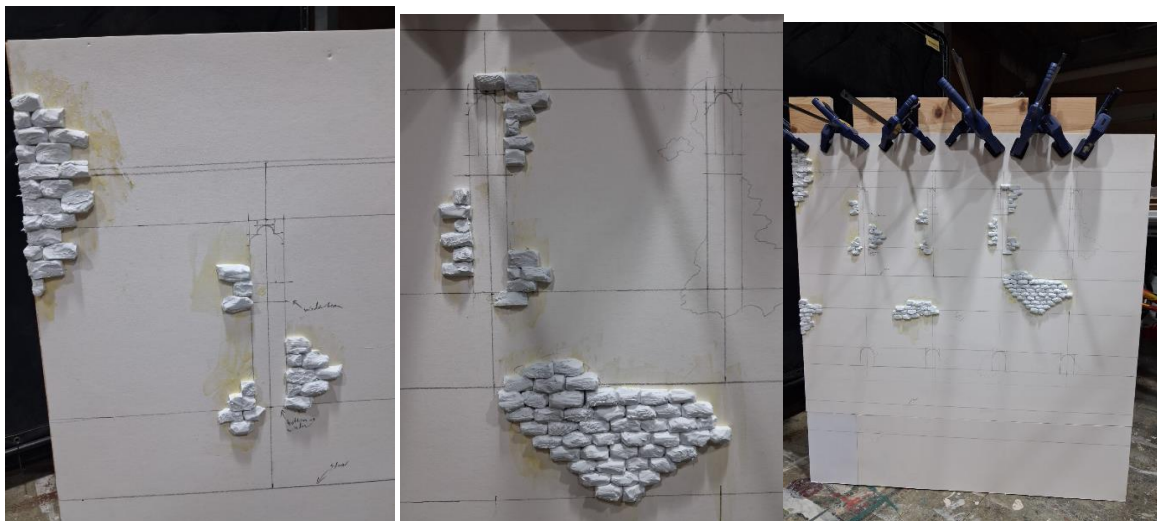
When the glue had dried, I then took off all the weights and clamps revealing the final result. Apart from the bottom left square which is slightly the wrong colour, which will be plastered over, the construction of the main structure has gone pretty smoothly, as there have yet to be any major errors. Using the measurements from my castle research and the full scale set, I drew on the placements of the windows. The top windows are based off of the full scale set, as this will create a link between the two, allowing the audience to connect the two together and know where the interior scenes are set. However I then based the bottom windows off of those on the tower of London, as I didn't feel tall windows would fit in the measurements or look aesthetically pleasing.

The arched windows on the bottom is also historically accurate as it was used on the tower of London which is in my desired time frame.

Adding Bricks



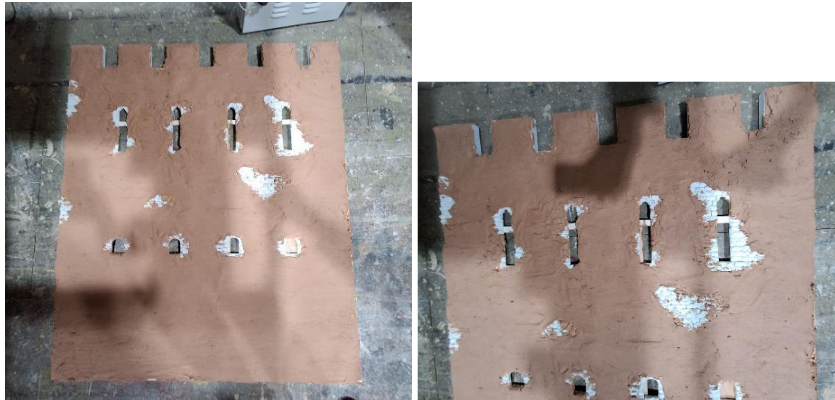
Using the foam board from earlier, I carved it into small miniature bricks which measured roughly 0.5 X 1 inches, which is 1:10 scale of the 5 X 10 bricks I measured from Castell Dryslwyn, which is the location I will be filming at. I was able to attach the foam bricks to the mountboard surface by using contact adhesive, as it is relatively fast drying and holds the two surfaces together in a tight bond.



As the bricks were all carved with varying heights, I decided to place the taller bricks away from the windows as this would make it harder to plaster, as I would have to create a thicker layer of plaster which would be harder to shape around the window.

You can also see in the far-right photo that I also began to glue the merlons on with wood glue, which I then held together with clamps.

Plastering

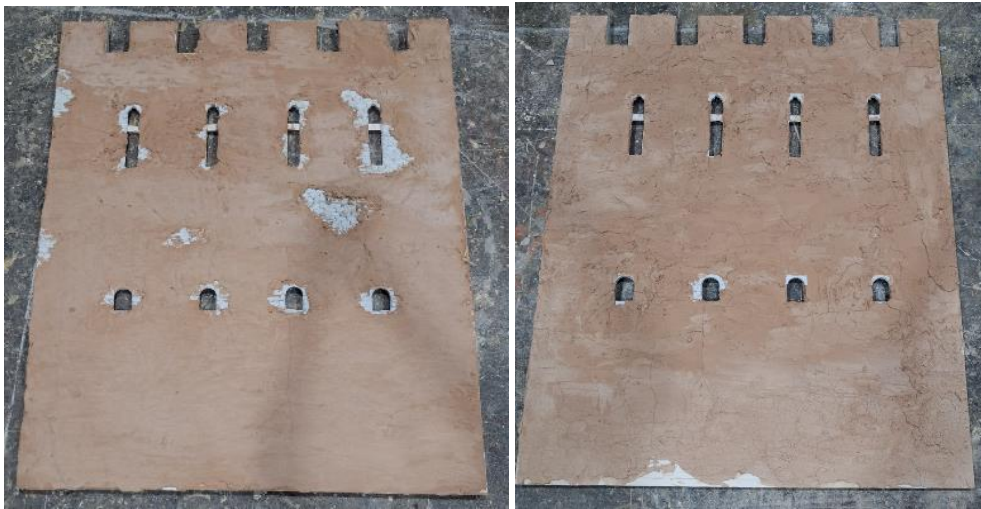


After the merlons were stuck on and cladded with mountboard, I then cut out the windows of the model and began to plaster. Using the information gained from my previous test pieces I made sure that the plaster wasn't too watery or too thick, and was somewhere in the middle.

The test results for these came back quite positively as all the different methods and materials all gave me the desired effect, which allowed me to choose the most cost and budget efficient techniques. However I had not accounted for the increased size of the model, compared to the test pieces, which resulted in parts of the model warping due to the increased weight and effects of the materials. To tackle this, I placed space pieces of wooden off cuts underneath the drying model, which would hold and keep the surface level, to reduce the effects of the extra weight and reduce the amount of warping.

So this is something I will definitely be focusing on and taking into an account in future model making projects, in terms of applying my research into a practical setting. If I we're to plaster scale models in the future I would look into using more wood based materials (3) which were used in the '*Blade Runner 2049*' for their much larger scale models.

Plaster drying



As you can see in the photos above, we can now see the finished results of the dried plaster, which I left to dry for roughly 5-6 days to make sure the plaster was completely dry before painting. I'm quite happy with the way it turned out, I think there is a lot of interesting texture which will be able to be seen on camera. However there were some issues when it came to cracking, as I used a dryer mixture of plaster for the second wall, seen in the right photo, to try and prevent the mountboard from warping. This did not have the desired effects, as it was still heavy enough to warp the mountboard and ended up becoming too dry and cracking.



As shown in the photos above, there were some instances where the plaster cracked due to the lack of water in the. If I were to do this again I would use the same mixture as before, but with an improved structural cladding.





I am also quite please with the outcome of the foam bricks under the plaster, as I feel this gives the model a sense of depth, structure and weight, which will further increase the realism and believability of the model in the film. You can also see in the photos that I added foam arches to the windows, this ensured that the curved shapes of the windows were kept while plastering, as I did not feel I had the skill set to execute this effect correctly.

Painting



To start painting the plastered surface, I first had to add a layer of primer. To do this I used (4) white contract matt paint due to its low cost and permeability, which “allows moisture to breathe through the paint film once applied”, this means that any moisture still left in the plaster will be able to escape and allow the plaster to fully dry. To mix the primer, I used a (5) one to ten mixture, which is 10 percent paint and 90 percent water, as the water will help hold the primer to the plastered surface. This was a simple process as I simply used a bowl and brush to mix the primer, as seen in the left photo, which I then applied as two coats to the plaster, as seen in the middle and right photo, to make sure the primer got into the small details and textures.



After I primed the surface with two coats of primer, I then applied a thicker mixture of paint, as this would give me a solid white colour. Another reason I chose the emulsion paint is because I was able to use it for both the primer and top coat, which allows me to reduce the overall cost. I also found that adding the topcoat was able to hide most of the cracked plaster, giving me the desired look.

Weathering



To weather the model, I was able to find some Bristol Super Scenic Black paint in the work shop, as I would only need a very small amount in a (6) very watered down

mixture. This is because I will be using black on a very white surface, which I only want to highlight the. I also used a spray bottle to dampen the surface before weathering, as this would keep the paint from drying too quickly and make it easier to move the paint around. I then used a brush to apply the paint to the surface which I would immediately take off with paper towels, to only allow a very small amount of paint to stick.



As seen in the photo above, I started off by weathering the wall on the right, as it will be seen less on camera, but I found that too much paint stuck to the surface, which left an undesirable dark mark. I ended adding more water to the mixture to make the black less prominent, which I was able to achieve on the rest of the model. The effects of the subtle weathering are more noticeable when compared to the non-weathered wall on the left.



I then weathered down the left wall, which I focused on weathering the small details, such as the brick and rough textures, which I think looks more realistic than the previous weathering attempts.

Filming

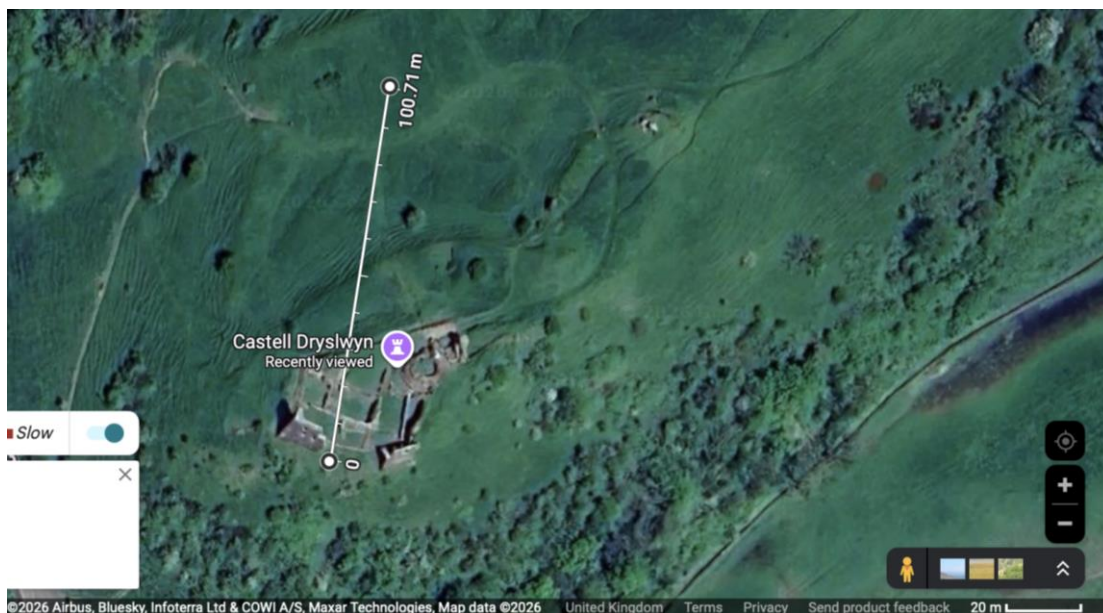
To film the exterior and interior shots I used a Lumix GH5 DSLR, as it is easy to use and fit for a wide range of filming set ups, with a Lumix 12-60mm Lens as it is able to film both landscapes and close up interior shots. I did test out a longer range lens, but this was too powerful for the range I was working at. I landed on these specific cameras and lenses while talking to the technical demonstrator in the TnL building, as I do not know enough on the subject to make an accurate judgement.



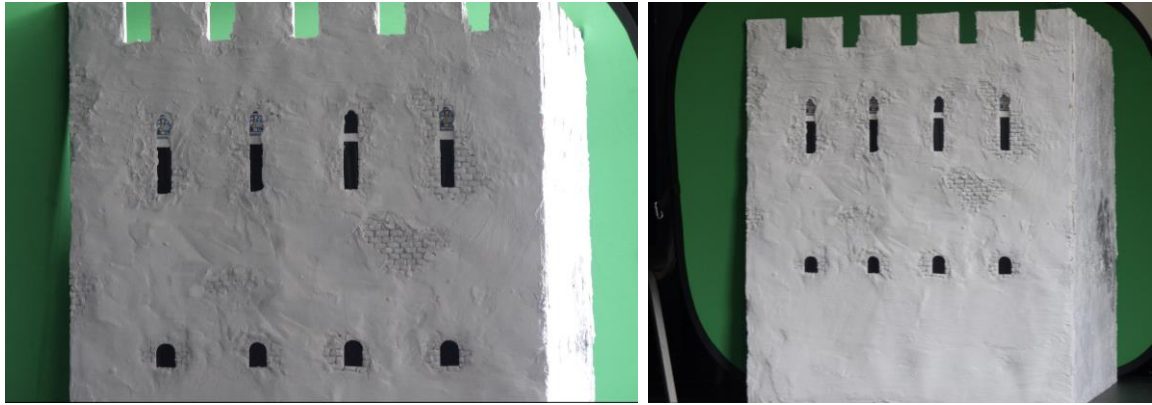
I tested out using both of the lenses, but found the long lens in the left photo was too powerful for the shots I wanted. We can see in both photos that I used a tripod, which simply keeps the camera still and level while filming, however the wind was so strong that it shook the camera while shooting, but the stance on the tripod kept it from falling over.



This is the set up on location at Castell Dryslwyn, I was positioned roughly 100m away from where I wanted my model to be in the film, so I would film the model from 10m away, due to the 1:10 scale.

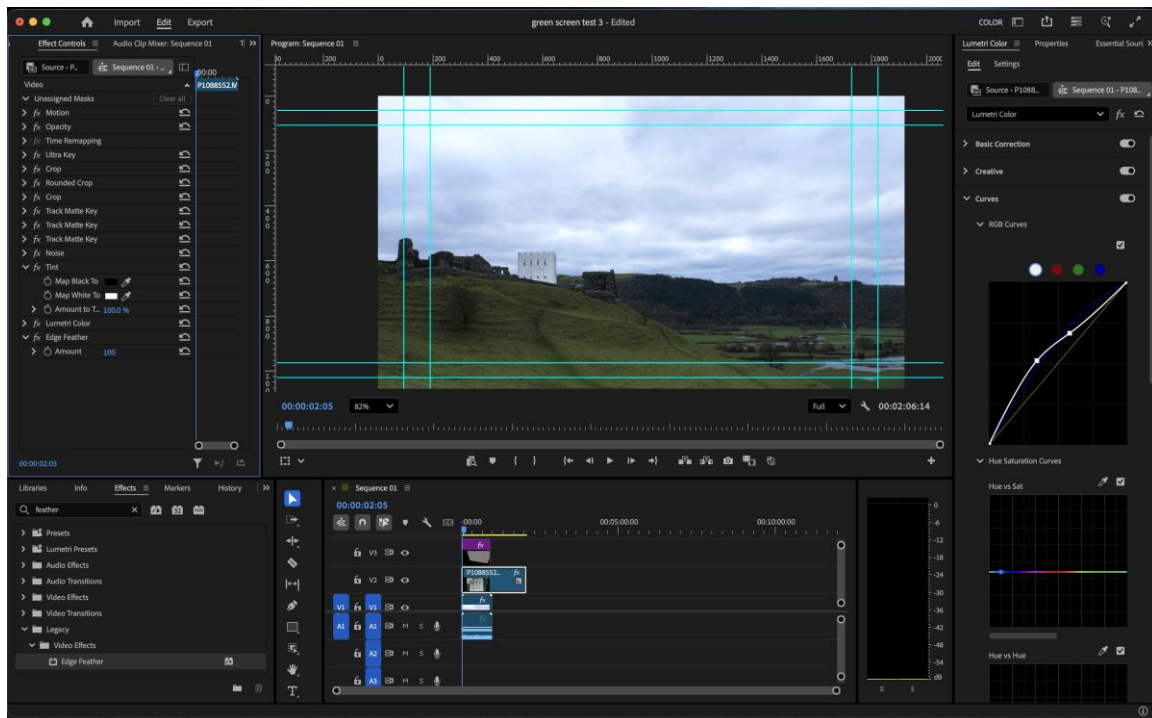


To measure how far I was from where the model castle would be, I used (1) google maps to correctly measure the distance.



I had to film the model in front of a portable greenscreen, so I was able to later impose the model into my on location footage. I decided to use natural light to film the model, as I felt filming the model in real light would look the most natural and convincing. Using natural light also took away the need for lighting set ups, which saved me on time. However, I did have to turn on some of the working lights, as the model and screen were not evenly lit. As previously mentioned, I filmed the model from 10m away, to keep in the 1:10 scale of filming 100m away on location.

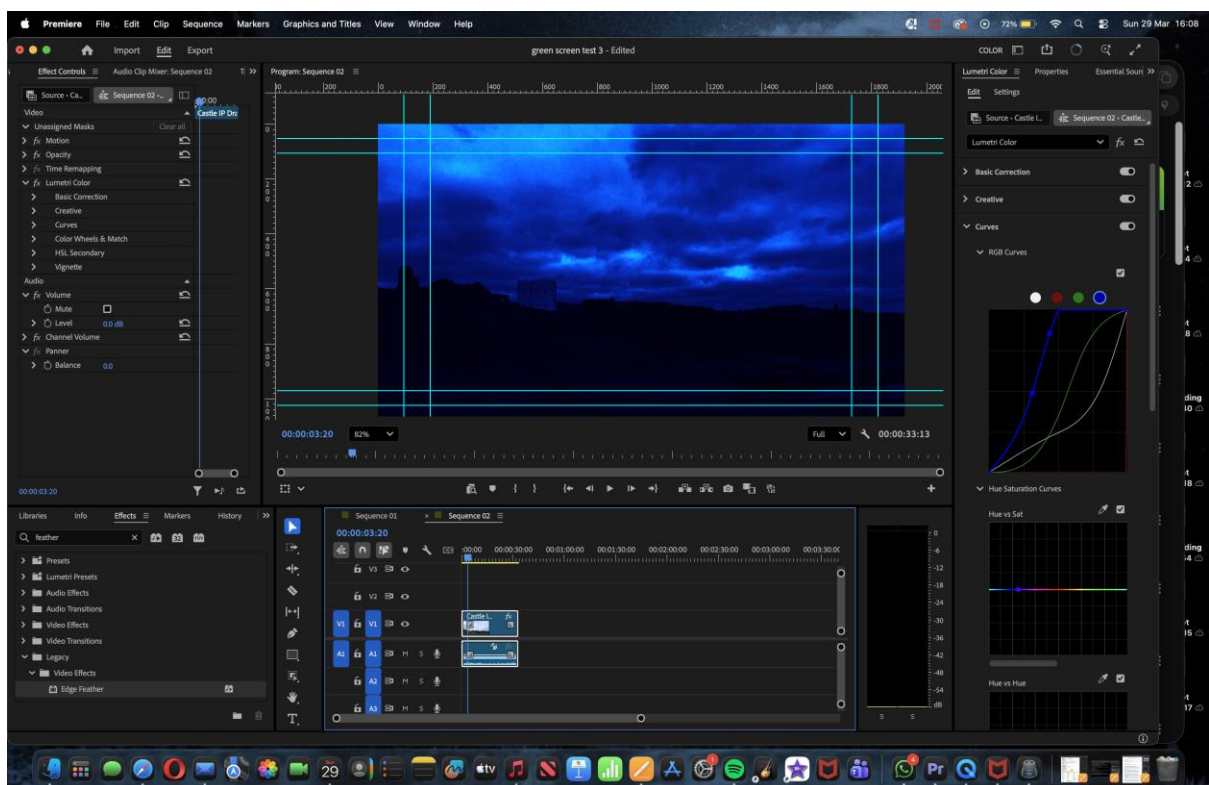
Editing



After I had all the footage I then inserted it into Premier Pro, as I have some experience using the software and will be able to create the desired shot. I had to use the (1) “Ultra Key” effect to remove the green screen from the model footage, which works by selecting a colour in the footage you wish to remove and then creates a blank space in the video. I then cropped as close to the model as I would, leaving me with a video of just the castle without any backgrounds. To make the castle look as if it was behind the hill, I had to use the (2) “Track Matte Key” effect, which allowed me to draw a shape on the footage and create a unique cropped shape for the model castle.



The video above is a test piece of the footage, which has some issues when it comes to the camera movement, as the background moves without the castle. Due to skill and time restrictions, I am currently unable to solve this issue. However, I feel with the right skill sets, this is a problem I would aim to solve in the future.



To hide this issue, I altered the colour levels to try and hide the seam between the hill

and castle. I feel this works for now, as I like the aesthetic value of it, but would like to work on solving this issue going forwards.

Final Results



Here is the finished shot, apart from the issue previously stated, I am quite happy with the way it turned out as I feel with the colour grading I added to the shot, gives it a dramatic aesthetic and would work well within a film.

I feel this outcome is suitable for a small student project like ours, but I do not feel the results are suitable for a larger scale film. In the context of a student film when the quality of all departments are not to the industry standard, this shot fits in, but a production working at an industry, it does not work.

When taking into account the cost of the tools and materials bought for this project, the whole shot cost a total of £49.04. However, as the model can be reused for other sequences and even films, over time this would give the model a greater value in the long term.

Conclusion

During my research, I have found that the main push for the use of special effects is down to the economics, as it has been used as a tool to bring in audiences and make higher profits to the studio, which drove the studios to develop and innovate in their special effects, including miniatures. This can be seen as far back as the 1920s but also in the 1960s when studios departments dismantled for financial reasons.

After my interview with Jose Granell I found that even the top professionals in the miniature industry are struggling to find work. I was also made aware of the threat that AI now has on the CGI industry, which has put into perspective how far the film industry has moved on from using miniatures. However, during this interview I also found that there are times where miniatures are the easiest and most cost-effective solution.

So in conclusion, under the correct circumstances and leadership, miniatures can be the most effective and financial option and is therefore able to be relevant but only under rare circumstances. Due to the lack of work in the industry, I do not think miniatures will be used more than they currently are in the future, and should not be pursued as a career.

But as I was able to design, build, shoot and edit a miniature, with very little skills, knowledge and budget for a film with my peers. I would say miniatures are still relevant to small scale independent films, due to financial, ease of use and accessibility as a resource.

Bibliography

Books

1. Keith Orton (2004) *Model Making For Stage*. Wiltshire: The Crowood Press Ltd.
2. John R Kenyon (1990) *Medieval Fortifications*. Leicester and, London: Leicester University.
3. Mark Cousins (2011) *The Story of Film*. 3rd Edition. London: Pavilion Books.
4. M. Eve Dutton (1970) *A Students' Guide To Model Making*. Australia: Pergamon Press.
5. Colin Platt (1982) *The Castle in Medieval England and Wales*. London: Secker & Warburg.
6. D. J. Cathcart King (1987) *Castles In Wales and The Marches*. Cardiff: University of Wales Press.
7. Jane Barnwell (2017) *Production Design For Screen*. London: Bloomsbury Publishing Plc.
8. W. Oren Parker, R. Craig Wolf (1996) *Scene Design and Stage Lighting*. 7th Edition. Texas: Harcourt Brace College Publishers.
9. Richard Rickitt (2006) *Special Effects, The History and Technique*. London: Aurum Press Ltd.
10. Jady Duncan (2006) *The Winston Effect, The Art And History of Stan Winston Studio*. London: Titan Books.

Websites

1. Action VFX (2020) *How To Use Miniatures With VFX Production*. Available at: <https://www.actionvfx.com/blog/how-to-use-miniatures-with-vfx-production> (Accessed 14/12/25)
2. The Knowledge Academy (2025) *History of VFX: A Revolution in Visual Effects*. Available at: <https://www.theknowledgeacademy.com/blog/history-of-vfx/> (Accessed 14/12/25)
3. Stan Winston School of Character Arts (2025) *Building Miniatures: Small-Scale Model Making - Part 1*. Available at: <https://www.stanwinstonschool.com/tutorials/building-miniatures-small-scale-model-making-part-3> (Accessed 14/12/25)
4. Tongal (2021) *Tips for Filming Miniatures*. Available at: <https://tongal.com/blog/community-guest-post/filming-miniatures-dear-tongal> (Accessed 14/12/25)
5. ACMI (2024) *They be little, they be fierce: miniatures used in sci-fi*. Available at: <https://www.acmi.net.au/stories-and-ideas/they-be-little-they-be-fierce-miniatures-used-sci-fi/> (Accessed 14/12/25)
6. Premium Beat (2015) *From the Moon to Galaxies Far, Far Away: Miniatures in Space*. Available at: <https://www.premiumbeat.com/blog/from-the-moon-to-galaxies-far-far-away-miniatures-in-space/> (Accessed 14/12/25)

7. BBC (2025) *KS3 History: Building a medieval castle*. Available at: <https://www.bbc.co.uk/teach/class-clips-video/articles/zdqwxyz> (Accessed 14/12/25)
8. Great Castles (2025) *Anatomy of a Castle*. Available at: <https://great-castles.com/anatomy.html> (Accessed 14/12/25)
9. Studio Tec (2023) *Creating Miniature Worlds*. Available at: <https://studiotec.info/2023/04/02/creating-miniature-worlds/> (Accessed 14/12/25)
10. BBC (2025) *The Marvellous Miniature Workshop*. Available at: <https://www.bbc.co.uk/programmes/m002n1pn> (Accessed 14/12/25)

Film History

1. PBS (2026) *The Early History of Motion Pictures*. Available at: <https://www.pbs.org/wgbh/americanexperience/features/pickford-early-history-motion-pictures/> (Accessed 6/1/26)
2. Science and Media Museum (2013) *THE MYSTERY OF LOUIS LE PRINCE, THE FATHER OF CINEMATOGRAPHY*. Available at: <https://blog.scienceandmediamuseum.org.uk/louis-le-prince-created-the-first-ever-moving-pictures/#:~:text=The%20mystery%20of%20Louis%20Le,clues%20as%20to%20his%20whereabouts> (Accessed 6/1/26)
3. Mark Cousins (2011) *The Story of Film*. 3rd Edition. London: Pavilion Books. (Accessed 6/1/26)
4. Richard Rickitt (2006) *Special Effects, The History and Technique*. London: Aurum Press Ltd. Available at: [https://en.wikipedia.org/wiki/Matte_\(filmmaking\)#:~:text=Other%20shots%20may%20require%20mattes,also%20more%20difficult%20to%20accomplish.](https://en.wikipedia.org/wiki/Matte_(filmmaking)#:~:text=Other%20shots%20may%20require%20mattes,also%20more%20difficult%20to%20accomplish.) (Accessed 7/1/26)

5. Wikipedia (2026) *Special effects of Terminator 2: Judgment Day*. Available at: https://en.wikipedia.org/wiki/Special_effects_of_Terminator_2:_Judgment_Day (Accessed 7/1/26)
6. IMDB (N/A) *Harry Potter and the Philosopher's Stone*. Available at: <https://www.imdb.com/title/tt0241527/> (Accessed 7/1/26)
7. Harry Potter (2021) *Explore behind the scenes of Harry Potter and the Philosopher's Stone with this special video series*. Available at: <https://www.harrypotter.com/features/explore-behind-the-scenes-with-harry-potter-filmmakers> (Accessed 8/1/26)
8. Callum, C. (2026) Zoom meeting Jose Granell, 26 January.
9. IMDB (N/A) Available at: <https://www.imdb.com/title/tt0371746/> (Accessed 7/1/26)
10. Industrial Light & Magic (N/A) *Iron Man*. Available at: <https://www.ilm.com/vfx/iron-man/> (Accessed 2/2/26)

Jose Granell Interview Bibliography:

1. Callum, C. (2026) Zoom meeting Jose Granell, 26 January.
2. Wētā Workshop (2017) *Blade Runner 2049 Miniatures | Behind the Scenes with Wētā Workshop*. Available at: <https://www.youtube.com/watch?v=sLxxbfsj8IM> (Accessed 22/3/26)

3. BAFTA (2023) *Making the miniature world of Asteroid City with Simon Weisse* | BAFTA. Available at: <https://www.youtube.com/watch?v=-D-7aLYzhrY> (Accessed 22/3/26)
4. Before and Afters (2021) *Miniature ships, big impact*. Available at: <https://beforesandafters.com/2021/03/19/miniature-ships-big-impact/#:~:text=The%20inclusion%20of%20real%2C%20physical,John%20Goodson%20and%20Dan%20Patrascu>. (Accessed 22/3/26)
5. Jose Granell Sculpture (2020) *About Jose*. Available at: <https://www.josegranellsculpture.com/#about> (Accessed 22/3/26)
6. IMDB (N/A) *Frankenstein*. Available at: <https://www.imdb.com/title/tt1312221/> (Accessed 22/3/26)
7. IMDB (N/A) *Charlie and the Chocolate Factory*. Available at: <https://www.imdb.com/title/tt0367594/> (Accessed 22/3/26)
8. IMDB (N/A) *Harry Potter and the Chamber of Secrets*. Available at: https://www.imdb.com/title/tt0295297/?ref_=nm_flmg_job_1_accord_1_cdt_t_1_0 (Accessed 22/3/26)
9. IMDB (N/A) *Harry Potter and the Prisoner of Azkaban*. Available at: https://www.imdb.com/title/tt0304141/?ref_=nm_flmg_job_1_accord_1_cdt_t_9 (Accessed 22/3/26)
10. IMDB (N/A) *Harry Potter and the Goblet of Fire*. Available at: https://www.imdb.com/title/tt0330373/?ref_=nm_flmg_job_1_accord_1_cdt_t_5 (Accessed 22/3/26)
11. IMDB (N/A) *Harry Potter and the Half-Blood Prince*. Available at: https://www.imdb.com/title/tt0417741/?ref_=nm_flmg_job_1_accord_1_cdt_t_1 (Accessed 22/3/26)

12. La Biennale Di Venezia (2026) *FRANKENSTEIN BY GUILLERMO DEL TORO WINS THREE ACADEMY AWARDS*. Available at: <https://www.labiennale.org/en/news/frankenstein-guillermo-del-toro-wins-three-academy-awards> (Accessed 22/3/26)
13. IMDB (2025) *Guillermo del Toro's 'Frankenstein' Tops Netflix Charts with 29.1 Million Views in 3 Days*. Available at: <https://www.imdb.com/news/ni65569145/> (Accessed 22/3/26)
14. Oxford Learner's Dictionaries (N/A) *Relevant*. Available at: https://www.oxfordlearnersdictionaries.com/definition/american_english/relevant#:~:text=%2F%CB%88r%C9%9Bl%C9%99v%C9%99nt%2F,me%20all%20the%20relevant%20information. (Accessed 22/3/26)
15. Merriam Webster (2026) *Relevant*. Available at: <https://www.merriam-webster.com/dictionary/relevant> (Accessed 22/3/26)

Castle research

1. John R Kenyon (1990) *Medieval Fortifications*. Leicester and, London: Leicester University.
2. BBC (N/A) *Castles*. Available: <https://www.bbc.co.uk/bitesize/articles/zq8t6g8> (Accessed 14/1/26)
3. Britannica (2026) *The Normans*. (1066–1154). Available: <https://www.britannica.com/place/United-Kingdom/The-Normans-1066-1154> (Accessed 14/1/26)
4. Colchester + Ipswich Museums (N/A) *History*. Available: <https://colchester.cimuseums.org.uk/visit/colchester->

[castle/history/#:~:text=Colchester%20was%20the%20first%20of,measures%2046%20by%2033.5%20metres.](#) (Accessed 14/1/26)

5. BBC (2014) *Rochester Castle*. Available at:
https://www.bbc.co.uk/kent/discover_kent/castles_houses/rochester.shtml
(Accessed 14/1/26)
6. Core Conversation (2026) *A Brief History Of Lime Plasters*. Available at:
<https://www.coreconservation.co.uk/technical-page/history-of-lime-plasters/>
(Accessed 15/1/26)
7. Conserv (2026) *LIME MORTAR (NON-HYDRAULIC) - FINE STUFF (25KG)*. Available at: <https://www.lime-mortars.co.uk/lime-mortar/non-hydraulic/fine-stuff/25kg> (Accessed 15/1/26)
8. Finding the Universe (2026) *YOUR COMPLETE GUIDE TO VISITING THE TOWER OF LONDON*. Available at: [tower-of-london-guide](#) (Accessed 15/1/26)
9. A View on Cities (2025) *Tower of London*. Available at:
<https://aviewoncities.com/london/tower-of-london#:~:text=palace%20in%20Westminster.,White%20Tower,walls%20are%204.6%20meter%20wide.> (Accessed 16/1/26)
10. IHBC (2021) *Crenellations on buildings*. Available at:
https://www.designingbuildings.co.uk/wiki/Crenellations_on_buildings
(Accessed 16/1/26)

Filming Location Options

1. Google Maps (2026) *Castell Coety*. Available at:
<https://maps.app.goo.gl/N1PwoCcznamwPbMi8> (Accessed 1/2/26)

2. Google Maps (2026) *Ogmore Castle*. Available at:
<https://maps.app.goo.gl/vPpSkctvGXgJmj21A> (Accessed 1/2/26)
3. Google Maps (2026) *Pennard Castle*. Available at:
<https://maps.app.goo.gl/bE3WzAL2Cj62jCKW7> (Accessed 1/2/26)
4. Google Maps (2026) *Castell Oxwich*. Available at:
<https://maps.app.goo.gl/6Jdt8uKwW6EzByQx6> (Accessed 1/2/26)
5. Google Maps (2026) *Castell Dryslwyn*. Available at:
<https://maps.app.goo.gl/1WmyLYgpuYbscNwL6> (Accessed 2/2/26)
6. Cadw (N/A) *Castell Dryslwyn*. Available at: <https://cadw.gov.wales/visit/places-to-visit/castell-dryslwyn> (Accessed 2/2/26)
7. Google Maps (2026) *Carreg Cennen Castle*. Available at:
<https://maps.app.goo.gl/3VrCp7RLWy3ZQRhbA> (Accessed 2/2/26)
8. Cadw (N/A) *Castell Carreg Cennen*. Available at:
<https://cadw.gov.wales/visit/places-to-visit/castell-carreg-cennen> (Accessed 3/2/26)
9. Google Maps (2026) *Kidwelly Castle*. Available at:
<https://maps.app.goo.gl/k3B3pwE3mL2Ho5RAA> (Accessed 3/2/26)
10. Google Maps (2026) *Carew Castle*. Available at:
<https://maps.app.goo.gl/R4zXd8aSFwDyoVy68> (Accessed 3/2/26)
11. Google Maps (2026) *Pembroke Castle*. Available at:
<https://maps.app.goo.gl/FaMG2vUsdNMVM6qs9> (Accessed 3/2/26)
12. Google Maps (2026) *Castell Llansteffan Castle*. Available at:
<https://maps.app.goo.gl/Fu4LyU2VYWKQRK5c8> (Accessed 3/2/26)
13. Google Maps (2026) *Castell Dinefwr*. Available at:
<https://maps.app.goo.gl/LjZGJZo4t1QsHxCQA> (Accessed 3/2/26)

Material Research

1. Keith Orton (2004) *Model Making For Stage*. Wiltshire: The Crowood Press Ltd.
2. M. Eve Dutton (1970) *A Students' Guide To Model Making*. Australia: Pergamon Press.
3. LionPic (N/A) *Mountboard & Sheet Material*. Available at: <https://www.lionpic.co.uk/mountboard-sheet-material/> (Accessed 29/2/26)
4. Dan Neat (2014) *Making 'white card models' for film or television design*. Available at: <https://davidneat.wordpress.com/tag/working-with-mountboard/> (Accessed 29/2/26)
5. Chair Office (2026) *Paper Sizes and Dimensions*. Available at: <https://www.chairoffice.co.uk/blog/paper-sizes-and-dimensions/> (Accessed 2/3/26)
6. Plastic Sheet Shop (N/A) *PVC Foam Boards*. Available at: [hop.co.uk/foamboard/#:~:text=A%20foam%20board%20can%20be,more%20precise%20cut\)%20mill%20it.](http://hop.co.uk/foamboard/#:~:text=A%20foam%20board%20can%20be,more%20precise%20cut)%20mill%20it.) (Accessed 2/3/26)
7. Samy – Model Maker. (2024) *Village on the Italian coast | Diorama –Tutorial*. Available at: <https://www.youtube.com/watch?v=z3rM91sovFE> (Accessed 2/3/26)
8. Ilkeston Ply & DIY (N/A) *Thistle MultiFinish Plaster 25kg*. Available at: <https://www.ilkestonply.co.uk/multifinish-25kg> (Accessed 4/3/26)
9. Screw Fix (N/A) *How to PVA Before Plastering*. Available at: <https://www.screwfix.com/guides/building-doors/plastering/how-to-pva-before-plastering> (Accessed 4/3/26)
10. Sanvo (2021) *What Is Contact Adhesive And Its Usages*. Available at: <https://www.sanvochemicals.com/what-is-contact-adhesive-and-its-usages/> (Accessed 4/3/26)

11. Bondrite (N/A) *Contact Adhesives For Rubber & Foam*. Available at:
<https://bondrite.co.uk/product-category/adhesives-by-use/contact-adhesives-for-rubber-foam/#:~:text=Contact%20adhesives%20are%20a%20versatile,to%20crafting%20and%20DIY%20projects>. (Accessed 5/3/26)

Building Process

1. Astor (2018) *What is a Corrugated Fastener*. Available at:
<https://www.astor.co.za/what-is-a-corrugated-fastener/#:~:text=A%20corrugated%20fastener%20is%20a,when%20driven%20into%20wood%20materials>. (Accessed 7/3/26)
2. Theatre Crafts (2021) *Flats - Types and Methods*. Available at:
<https://theatrecrafts.com/pages/home/topics/scenic-design/flats-types-methods/> (Accessed 7/3/26)
3. ACMI. Y (2025) *Wētā Workshop's Miniatures for Blade Runner 2049*. Available at: https://www.youtube.com/watch?v=HAIL_NTdpig (Accessed 7/3/26)
4. Painters World (2025) *The Best Paint For Plaster Walls & How To Apply It*. Available at: <https://paintersworld.co.uk/painters-advice/best-paint-for-plaster> (Accessed 7/3/26)
5. Dulux (2026) *Dr Dulux: How to Paint onto New Plaster*. Available at:
<https://www.dulux.co.uk/en/expert-help/dr-dulux-painting-on-new-plaster> (Accessed 8/3/26)
6. Adam Savage's Tested (2013) *One Day Builds: Adam Savage Demonstrates Weathering Tricks*. Available at:
<https://www.youtube.com/watch?v=YXzxEqdvuIE&t=967s> (Accessed 8/3/26)

Filming:

1. Google Maps (2026) *Castell Dryslwyn*. Available at:
<https://maps.app.goo.gl/UqqCpUmYDpgR3cG59> (Accessed 11/3/26)

Editing:

1. Roberto. B (2022) *EASY Green Screen Tutorial for Adobe Premiere Pro 2024 (STEP BY STEP + Free Preset)*. Available at: https://www.youtube.com/watch?v=-UFG_jU3bXA (Accessed 27/3/26)
2. Fanverse (2024) *Three ways to crop and mask a video in Premiere Pro // Quick Premiere Pro Howto*. Available at: <https://www.youtube.com/watch?v=8naHDDQxOhQ> (Accessed 27/3/26)