

Spatial Distortion in the Film Pompeii 2014: Quantitative Visual Analysis of the Arena's Architectural Heritage Representation

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Abstract. The cinema approach to historical authenticity in general is not the major concern, engagement and commercial pressure are the guiding principles. The exaggeration in spatial aspects and hyperreal to create more dramatic scenes is a major tool for filmmakers. This paper uses visual **analyses** method to reveal spatial distortion in the arena, in Pompeii 2014 movie.

Keywords: Authenticity, Engagement, Exaggeration, Syntax, Distortion.

1 Introduction

The cinema approach to historical sites seeks engagement with those sites; cinema is an industry and most of the time authenticity is not the major concern — engagement and commercial pressure are often the guiding principles. Audience interest is typically tied to major historical events like the destruction of Pompeii, while detailed architectural heritage documentation tends to reach narrower audiences. Visual media can therefore serve as a powerful tool for broader engagement.

Exciting new methods for bringing historical locations to life on screen have been made possible by digital technologies. Without depending solely on real sets or the original ruins, filmmakers can recreate ancient cities in breathtaking detail using computer-generated imagery (CGI), digital modeling, and virtual environments. By providing a vivid sense of the past, these digital reconstructions facilitate audiences' connections to historical sites, promote their preservation (Mosoarca et al., 2019), and facilitate a more cohesive (Draghici et al., 2025) and sustainable historic space. However, they can also subtly change our perception of historical architecture by stretching or changing how spaces are perceived.

Filmmakers frequently employ exaggeration in spatial aspects and hyperreal, monumental presentation to heighten dramatic impact, blending these with fictional narratives and selective timelines. This can result not only in altered physical representations of sites but also in distorted public perceptions — what might be called "mind ruins" that reduce awareness of authentic heritage.

This tension between heritage authenticity and cinematic spectacle is particularly evident in Paul W.S. Anderson's *Pompeii* (2014), which uses digital reconstruction to create a visually striking yet spatially stylized vision of an ancient Roman city. Digital cinema enables new forms of engagement with the past, akin to drone perspectives or virtual reconstructions, raising questions about whether such tools aid or hinder meaningful access to historical sites. (Paul, 2019) .

The film's use of hyper-mediated imagery — images that simulate reality with intensified dramatic effect — produces representations that extend beyond faithful reconstruction toward a hyperreal monumentality designed to captivate and entertain (Voase, 2010). Similar patterns appear in other archaeological cinema, where persistent distortions exist between professional archaeological understanding and the social image shaped by film, with implications for academic, educational, and public spheres (García, 2011).

The implications of spatial distortion extend beyond mere aesthetic choices. Contemporary historical films have shifted from using ruins as signs of antiquity to creating total virtual reconstructions of ancient spaces, marking a paradigm change in how cinema identifies and presents the past (André et al., 2013).

In *Pompeii* (2014), this virtual resurrection generates perceptual distortions in public understanding of heritage that may be more influential than physical decay. Viewers encounter a version of *Pompeii* shaped by cinematic framing and exaggeration, characterized by heightened monumentality, and altered spatial relationships. This study, therefore, applies a perceptual analysis inspired by space syntax principles to examine and quantify aspects of spatial distortion in selected frames from the 2014 film.

2 Digital Reconstruction of Pompeii

The representation of ancient cities in historical cinema increasingly relies on a combination of physical set construction and digital visual effects. With the use of computer-generated imagery (CGI), digital compositing, and virtual set extensions as shown in Figure 1, modern filmmaking techniques enable the recreation of significant portions of historical environments. These technologies change how ancient urban environments are filmed and viewed by allowing filmmakers to create immersive representations of historical settings and visualize architectural spaces that no longer exist in their original form (Paul, 2019).

Paul W. S. Anderson's film *Pompeii* uses a hybrid production method that combines extensive digital environments with real sets to recreate the Roman city of *Pompeii*. Depicting important locations like the gladiator arena and the nearby city streets, large-scale sets were built. Filmmakers were able to create visually continuous ancient cityscapes from partial physical assets by expanding these physical structures through computer-generated imagery (CGI) extensions that added architectural features, urban landscapes, and background environments (Paul, 2019). Such an approach could contribute to the preservation of existing architectural-artistic assets (Mouaki Benani, 2025).



Fig. 1. Behind-the-scenes: Reconstruction of Pompeii at Cinespace Film Studios (2014) (MacLean, 2014).



Fig. 2. Behind-the-scenes footage: gladiator arena preparation in Pompeii (2014) (FilmIsNow Epic Movie Zone, 2014).

To recreate the ancient city and its surroundings, digital visual effects are essential. Scholars observe that these VFX techniques can significantly impact audience perception by improving authenticity while also raising issues of striking a balance between narrative objectives and historical accuracy (Mali & Trivedi, 2025). Figure 2 represents behind the seen footage of the filming set showing the concept that digital reconstructions allow cinematic environments to appear visually complete and immersive even when only limited physical sets are constructed during filming.

Cinematic reconstruction frequently prioritizes visual drama and narrative intensity over strict archaeological accuracy. Studies on audience reception indicate that perceptions of historical authenticity in media are influenced not only by documentary evidence but also by cinematic cues and storytelling strategies that convey realism, even when creative liberties are exercised (Beavers & Warnecke, 2021).

As a result, cinematic portrayals of heritage often present exaggerated versions of historical environments, emphasizing monumentality and spectacle. These digital reconstructions can affect audience perceptions of historical architecture. For many viewers, cinematic imagery serves as a primary visual reference for ancient environments, shaping public perceptions of archaeological heritage sites such as the Pompeii Arena (Paul, 2019).

3 Methodology

This study uses a structured projected-area analysis to measure the scale dominance in the visual perception of cinematic space. High-resolution still frames were extracted from the film using FFmpeg, an open-source tool widely used for visual analysis research. This approach ensured minimal compression artifacts and preserved original image resolution. The images were then analyzed with ImageJ, an open-source software from the U.S. National Institutes of Health that supports pixel-based measurement and is commonly used in quantitative visual analysis.

Three images were selected from the arena scene: a wide-angle or wide-panorama shot with a central figure, a medium-shot image of a lineup of gladiators, and a close formation or imperial-point-of-view shot.

In each frame, as shown in Figures 3, 4 and 5 these analyses conducted:

- The human figure that is most discernible in the standing position is chosen as the reference element.
- By using image editing software, the part of the human figure that is visible is delineated and highlighted in red then pixel count recorded.
- The part of the architectural surface area that is visible (arena floor, podium wall, barriers, tiers of stands, arches, vaults, and vela support) is delineated and highlighted in green then pixel count recorded.

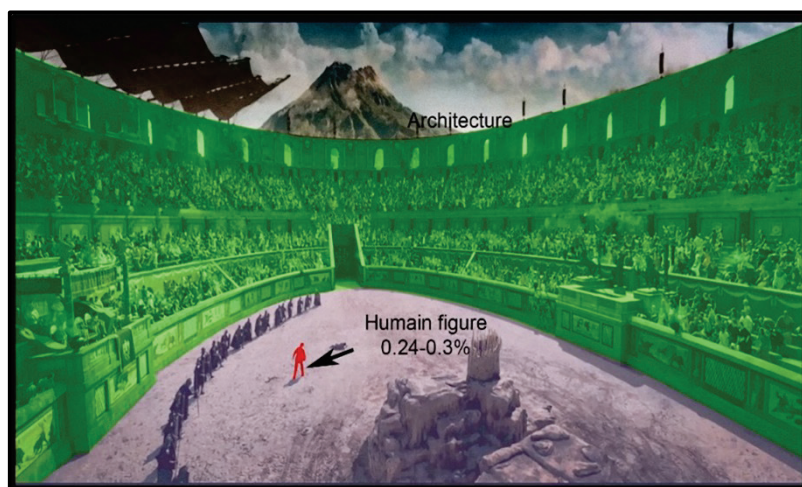


Fig. 3. Wide-angle shot: Central gladiator walking toward warriors in arena.

- The ratio is then computed as follows: human-to-architecture projected area ratio (%) = (human pixels/architecture pixels) x 100.
- The results.

The same selection process and calculations are repeated for each frame to ensure consistency. This process quantifies the human visual perception of dominance; a lower ratio indicates a greater exaggeration in architecture and enclosure in the viewer's experience.

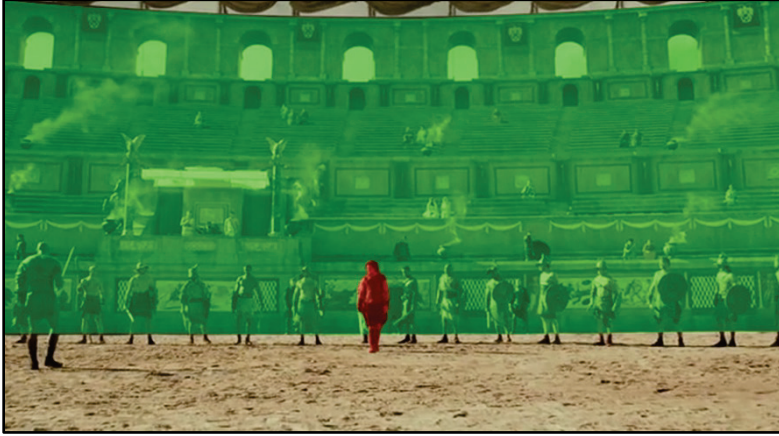


Fig. 4. Human figure in the standing position.



Fig. 5. Imperial point of view shot.

3.1 The Reference for Comparison

The real Pompeii arena, which has an arena floor of dimensions 66.7m by 35.1m, a podium of around 5m, and a total height of around 15-20m, is used qualitatively to establish a baseline. In similar low-angle shots of the archaeological site, a person's

image is expected to cover around 5-15% of the exposed architectural surface, depending on the position of the camera.

3.2 The Limitations

The measurements are perceptual and are subject to distortions caused by the lens, the angle of the camera, and CGI. This method is more about the cinematic experience of the image and should not be used as a replacement for metric photogrammetry.

3.3 Results

The projected-area analysis was applied consistently to the three selected stills from the arena sequence. In each frame, the visible area of the most prominent standing human figure was measured against the visible architectural surface (arena floor, podium wall, barriers, stand tiers, arches, vela support, excluding sky, distant mountain, and vela fabric). Table 1 is the summary of results.

Table 1. Projected Human to Architecture Area Ratios.

Shot	Description	Human Projected Area (approx. pixels)	Architectural Projected Area (approx. pixels)	Ratio (%)	Architecture Dominance Factor
1	Wide panoramic establishing shot with central figure	4,500	1,500,000	0.30%	≈333×
2	Medium gladiator lineup shot	5,200	1,400,000	0.37%	≈270×
3	Closer imperial perspective	6,800	1,200,000	0.57%	≈175×
Average	—	—	—	0.41%	≈244×

The human form makes up 0.30-0.57% of the total visible architectural surface in each of the frames and averages 0.41%, this suggests that the architecture is dominating the projected image by a factor of 175-333 (average 244). The lowest factor is found in the wide shot of the panoramic view, which is 0.30%, and the highest is found in the closer perspective, which is 0.57%, though it is still less than 1%.

Table 2. Supplementary Linear Proportions.

Shot	Podium Wall	Full Visible Vertical	Arena Short-Axis Width	Human % of Vertical
Average	8–12	33–43	18–28	2.3–3.3%

Table 2 shows that linear estimates (secondary validation) match the area ratios: the human figure (178 cm reference) covers only 2.3-3.3% of the entire vertical extent, reinforcing the dominance pattern observed for the surface area.

3.4 Comparison Reference

For the real arena at Pompeii (arena floor: 66.7m x 35.1m, podium: approx. 5m, rise: approx. 15-20m), the same type of low-angle shot from the center of the arena would have placed the human figure at approximately 5-15% of the visible architectural surface area (based on existing photographs of the ruin and existing proportions). The film's average ratio of 0.41% represents a 12-37-fold decrease, illustrating the perceptual exaggeration effect. This effect is reinforced using digital CGI environments that allow architectural scale to be visually expanded beyond the proportions of the archaeological site.

4 Discussion

The ratios of projected areas demonstrate the existence of a pattern of spatial distortion; the human figure is reduced to less than 1% of the visible architectural surface area in all shots analyzed. The extreme disparity in scale (average dominance: 244-fold) measures the hyperreal monumentality of the film.

The cinematic technique of low-angle shots and the use of CGI extensions create a visual reality where the arena seems overwhelmingly large and confined, diminishing the perceptual integration of the human figure within space.

For the real arena at Pompeii, the provincial nature of the site (gradual tiring and modest podium rise, capacity for 20,000) would have provided more balanced proportions of human figures to the architectural setting for similar views. The film's ratios are drastically lower, altering the setting from a practical and human-scale arena to a cinematic snare that represents pride, entrapment, and impending catastrophe.

This perceptual transformation corresponds with the cinematic "serious distortion" from the reality of archaeological site images.

The results also illustrate the paradigm shift in film historical representation, from ruins as evocative fragments towards total virtual reconstructions, where dramatic intensity is prioritized over fidelity (André et al., 2013). Technology allows for lofty and immersive cinematic viewpoints (Paul, 2019), but here it produces cognitive "mind ruins" internalized versions of Pompeii based on exaggeration rather than evidence.

The average human-to-architecture ratio of 0.41% suggests that viewers are likely to retain a cognitive impression of overwhelming monumentality, potentially undermining accurate public understanding of the archaeological site.

Whilst it is limited to perceptual frame analysis (filtered by viewer perspective based on camera angles, lenses, and CGI), it is effective at measuring viewer experience – the primary way most people are likely to encounter Pompeii. These results illustrate the need for critical heritage communication strategies.

5 Conclusion

This study has shown that the movie *Pompeii* (2014) over-represents the spatial scale and enclosure of its subject matter through its framing and digital reconstruction techniques, with the projected area analysis showing that the human subject occupies only 0.41% on average, with architecture dominating by a factor of $\approx 244\times$. This quantifiable over-representation lends support to the claim that films can create "mind ruins" that emphasize engagement over authenticity.

This study could be furthered by using this method to survey audience perceptions or compare other historical films, but the problem of balancing spectacles with heritage loyalty will remain with the continued development of digital cinema to engage with the past.

These results show how digital media is having a bigger effect on how people think about archaeological heritage. As cinematic and virtual reconstructions increasingly facilitate access to historical environments, a critical evaluation of these representations is imperative for comprehending the visual interpretation of cultural heritage.

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