Visibility and Impact: The Role of Color on the Parthenon's Ionic Frieze

by

Rebecca Levitan

Dr. Bonna D. Wescoat
Adviser

Art History Department

Dr. Bonna D. Wescoat
Adviser

Dr. Jasper Gaunt
Committee Member

Professor Linda Armstrong
Committee Member

2013

Visibility and Impact: The Role of Color on the Parthenon's Ionic Frieze

By

Rebecca Levitan

Dr. Bonna D. Wescoat

Adviser

An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Art History Department

2013

Abstract

Visibility and Impact: The Role of Color on the Parthenon's Ionic Frieze
By Rebecca Levitan

Considering the painstaking effort, considerable expense, and numerous difficulties that were involved in creating the continuous Ionic frieze of the Parthenon in Athens, its placement far from eye level within the shadowy space of the pteroma seems counterintuitive. In contrast to the pedimental sculptures in the round or the metopes in high relief, both of which would have been visible from afar and clearly illuminated by Mediterranean sunlight, the frieze was created for a shaded, transitive space. For the past century, scholars have been baffled by the so-called "Paradox of the Parthenon Frieze," or why the Athenians made such a significant sculptural investment in a space with limited visual gains.

Greek artists used two tools to enhance the legibility of the frieze: relief carving and the application of pigment to the finished sculptures. Refinements in the carving of the frieze would have lent to its legibility, but they pale in comparison to the effect that color had on the viewer's ability to distinguish the many parts of the composition. In this thesis, I will argue that color provides the critical element that enhances visibility in the Parthenon frieze. This thesis re-evaluates the viewing problem of the Parthenon frieze through a study of the effects of color, and it includes an investigation of the use of polychromy on the Parthenon and the visual effects of these chromatic choices.

An understanding of the strategic use of color on the Ionic frieze has been incorporated into the second part of this thesis: an experiment in practical archaeology. For the experiment, full sized color panels were created to replicate the viewing experience of the northwest corner of the frieze. These frieze panels were installed on a to-scale replica of the complete Parthenon in Nashville, Tennessee, to gauge visibility and the role of color in legibility. The experiment along with this thesis will demonstrate that the role of color was paramount in the viewing experience of the frieze as it was originally conceptualized.

Visibility and Impact: The Role of Color on the Parthenon's Ionic Frieze

By

Rebecca Levitan

Dr. Bonna D. Wescoat

Adviser

A thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Art History Department

2013

Acknowledgements

Many thanks to Dr. Bonna Wescoat, the Michael C. Carlos Museum, and the Nashville Parthenon for allowing this study to take place.

Visibility and Impact: The Role of Color on the Parthenon's Ionic Frieze

Table of Contents

Introduction

Earth proudly wears the Parthenon as the best gem upon her zone.
- Ralph Waldo Emerson, *The Problem,* 1900

There is nothing to equal [the Parthenon] in the architecture of the entire world and all the ages.

- Le Corbusier, *Towards a New Architecture,* 1923

Considering the painstaking effort, considerable expense, and numerous difficulties that were involved in creating the continuous Ionic frieze of the Parthenon in Athens, its placement far from eye level within the shadowy space of the pteroma seems counterintuitive. In contrast to the pedimental sculptures in the round or the metopes in high relief, both of which would have been visible from afar and clearly illuminated by Mediterranean sunlight, the frieze was created for a shaded, transitive space. For the past century, scholars have been baffled by the so-called "Paradox of the Parthenon Frieze," or why the Athenians made such a significant sculptural investment in a space with limited visual impact.

The scholars puzzled by the "Parthenon Paradox" have not fully analyzed the implications of one major compositional aspect of the frieze: color. This thesis will argue that color provides the critical element that enhances visibility in the Parthenon frieze. The following chapters will re-evaluate the viewing problem of the Parthenon frieze through a study of the effects of color, including an investigation into the use of polychromy on the Parthenon and the visual effects of these chromatic choices.

Greek artists used two tools to enhance the legibility of the frieze: relief carving and the application of pigment to the finished sculptures. Refinements in the carving of the frieze certainly lent to the sculpture's legibility, but they pale in comparison to the effect that color had on the viewer's ability to distinguish the many parts of the composition. In the shaded, recessed space of the pteroma, horses of many shades pranced, walked and galloped across a blue background. White himatia, multi-colored cloaks, and detailed sandals and boots variously adorned the figures.[1] The procession of the Ionic frieze was not obfuscated by shadows; it was illuminated and elucidated by a varied palette.

Scholars in the 20th and 21st centuries have largely downplayed the role of color on Classical architecture and architectural sculpture, deeming it a "final touch" or an "augmentation."[2] This attitude was reinforced by the fact that color is largely absent on the extant blocks, while the relief carving is preserved to a fairly high degree. Furthermore, the fantastical and overly fervent color reconstructions from the late 18th and 19th centuries, which flew in the face of modernist sensibilities, tarnished the value of scholarship on ancient polychromy.[3] Thus, the role of color has often been dismissed or downplayed in more modern examinations of how ancient worshippers experienced the Parthenon.

There is one place where visitors can imagine the Parthenon and its many pieces fitted back together as a unified whole: Nashville, Tennessee. In 1897 a full-scale replica of the Athenian Parthenon was constructed in Nashville for the city's Centennial Exposition. Due to its overwhelming popularity, the building was rebuilt in permanent materials in the 1920s under the supervision of American architect William Bell Dinsmoor.[4] Dinsmoor had made detailed drawings and measurements of blocks from the ancient building, ensuring that even the minutest refinements would be included in the temple in Tennessee: the Nashville Parthenon replicates the measurements of its Athenian predecessor to the centimeter.[5] Positioned in a public park and

---

[1] Neils, 2001, 33.
[2] Ridgway, 1999, 114.
[3] Prater, 2008, 35.
[4] Nashville Department of Parks and Recreation, 2013.
[5] Dinsmoor, 1913, 56.

frequently visited by Nashville residents and tourists, in some ways Dinsmoor's Parthenon conveys a better impression of the original Parthenon than a visit to the Athenian Acropolis today, for it replicates the Athenian building as it originally stood, complete with roof, cella, and 40 foot statue of Athena. However, the Nashville Parthenon does not have an Ionic frieze; its installation was indefinitely stalled by the great financial crisis of 1929.

In an effort to evaluate how the Ionic frieze contributed to the original viewing experience of the Parthenon, an Emory team conducted an experiment at the Nashville Parthenon, which gauged the visibility of the frieze. The empty Ionic frieze course, accurate in scale, made Dinsmoor's Parthenon in Nashville the ideal site for the experimental portion of this thesis. For the experiment, life sized color panels were created to replicate the viewing experience of the frieze. These frieze panels were installed on the northwest corner to assess visibility and the role of color in legibility. The experiment along with this thesis will address questions about the visibility and legibility of the Ionic frieze and demonstrate that the role of color was paramount in the viewing experience of the frieze as it was originally conceptualized.

Chapter One: The Viewing Problem

Shadows can be infinitely obscure or display an infinity of nuances in the light tones. Shadows are the manifestation by bodies of their forms. The forms of bodies would not show their particularities without shadow.

Leonardo da Vinci, *On Painting*

The Parthenon is one of the world's most iconic monuments. The pure visual impact the building wields is rivaled by few other structures (Fig 1.1). The Parthenon's status as an "architectural gem"[6] was true the day the building was completed in 432 BC and this preeminence has not faded with time or decay, as attested by the millions of tourists who come to marvel each year. It has been adopted as the visual shorthand for the political, artistic, and philosophical cannon that undergirds Western Civilization and is almost mythical within Western culture: Freud was surprised when seeing the Parthenon for the first time in 1904 that the building did, in fact, exist "just as we learnt at school."[7] As a result, there is little about the Parthenon that has not been studied in detail.

The Parthenon was originally built to serve as the temple to Athena Parthenos on the Acropolis in the powerful and democratic Greek city-state of Athens. In addition to its religious role, the Parthenon also had political bases. It was a testament to the Greek victory in the Persian Wars. It was set over an earlier temple to Athena begun on the south side of the Acropolis shortly after 490 to commemorate the seemingly miraculous victory over the Persians at the Battle of Marathon; for every Greek death in the battle there were approximately 32 Persian casualties.[8] The temple was meant to serve as both a gift to Athena, the goddess "responsible" for Greek victory, and as a war memorial. Quarrying for high quality white marble began at

[6] Stevens, 1936, 482.
[7] Kondaratos, 1994, 3.
[8] Hurwit, 1999, 155.

Pentelicon for the first ever all-marble peripteral Doric temple (Fig 1.2),[9] but this was never finished for the Persians returned and sacked the city of Athens in 480, destroying every building on the Acropolis (Fig 1.3).[10] After defeating the Persians at Salamis and Plataea in 480 and 479, Greek city-states unified under Athenian leadership and created the Delian League for security, an assembly that was meant to prevent another Persian attack by consolidating resources for a stronger Greek defense. Power continued to sway in the direction of Athens, and the treasury was moved from the island of Delos to the city of Athena in 454 BC.[11]

Pericles, the leader of the Athenian Democracy, was responsible for Athens' massive rebuilding campaign on the Acropolis (Figure 1.4).[12] Among the many buildings of the campaign, the Parthenon took pride of place. Construction of the new temple would be funded by the state and funds withdrawn from the Delian League's treasury. The assembly voted that the new temple would indeed be funded, complete with a gigantic image of the goddess made out of gold and ivory.[13] This idea would become the Parthenon that still stands in the center of Athens. According to Thucydides, Pericles did not find the commission excessive or bombastic, saying later of Athens in his Funeral Oration:

> … Our city is worthy of admiration. We cultivate refinement without extravagance and knowledge without effeminacy; wealth we employ more for use than for show, and place the real disgrace of poverty not in owning to the fact but in declining the struggle against it.[14]

The architects Iktinos and Kallikrates, are said to have designed the Doric peripteral temple of eight by seventeen columns (Fig 1.5). The sculptor Phidias was appointed as

---

[9] Korres, 2001, 10.
[10] Hurwit, 1999, 156.
[11] Hurwit, 1999, 156.
[12] Hurwit, 1999, 160.
[13] Hurwit, 1999, 168.
[14] Thucydides, Pericles' Funeral Oration

overseer of the entire project, including the massive chryselephantine statue. Construction began on the southeast side of the Acropolis in 447 BC. Phidias commanded a wide and varied group of builders, craftsmen, and artists. As Plutarch tells us "each individual craft, like a general with an army under his separate command, had its own corps of unskilled laborers at its disposal."[15]

In addition to the 42 foot sculpture that would reside inside the Parthenon, Phidias was also overseer of the four types of architectural sculpture that would adorn the outside of the building: pedimental sculptures, metopes, the Ionic frieze, and acroterial sculptures. All four were carved in Pentelic marble and fit seamlessly into the structure of the building. The use of all four types of architectural sculpture, a device that combined elements of Doric and Ionic architecture, was unprecedented in the Greek world. Phidias most likely served as the designer and distributed the task of carving to many other sculptors.[16] The fact that the architectural sculptures of the Parthenon were made by many hands is demonstrated by varying degrees of proficiency in the working of the same motifs such as the centauromachy depicted on the metopes – some of the scenes are masterful while others border on ungainly (Fig 1.6).[17]

Despite the logistics behind the quarrying, transportation, lifting, and finishing of the Parthenon's 13,400 stones, each different and specially cut, the building was completed in about fifteen years.[18] The Parthenon's prominent position on the Acropolis made it an important locus in the Panathenaia, a festival that was celebrated every four years on to

---

[15] Plutarch, *Pericles*
[16] Jenkins, Greek Architecture and Its Sculpture, 80.
[17] Beard, 2010, 141.
[18] Acropolis Restoration Service, 2013, online.

commemorate the birth of Athena. The festival included musical, poetry, and athletic events. It culminated in a grand procession up the Acropolis, attended all ranks of Athenian society.[19]

The Frieze and its Location on the Parthenon

The frieze blocks were probably set in place between 443 and 438 BC, after the completion of the metopes but before the pedimental sculpture was begun. Comprising 114 rectangular slabs of varying length, the frieze measures 160 m. in length and stands ca. 1.02 m. in height (Fig 1.7). It ran around all four sides of the building along the top of the cella wall (Fig 1.8), 15m from the floor of the pteroma (the space between the cella wall and the outer colonnade.) The procession it depicts begins at the southwest corner of the building and divides into two branches that eventually meet at the east side (Fig 1.9), where the Olympian Gods are depicted watching a ceremony that most likely involves the peplos woven for Athena (Fig 1.10). In contrast to the pedimental sculpture carved in the round which features about fifty figures, the frieze in its present state of preservation includes approximately 378 people: gods, men, women, and children, not to mention numerous horses and sacrificial animals that are also incorporated into the design.[20] The density of figures on each block varies as the carved procession progresses, with the west side featuring the least number of figures.

Unlike the pedimental or metopal sculpture, the frieze was not readily visible when approaching the exterior of the Parthenon (Figure 1.11). Instead, the viewer had to be much closer to the temple to view the sculpture.

Imagining the frieze that its artists had originally conceptualized is made difficult by several factors. The Parthenon as it stands today is a mere shell of its original self. The cella that housed the cult statue is almost completely gone (Figure 1.12). Likewise, the roof, which would

---

[19] In general, see Shear, 2001.
[20] Neils, 2006, 33.

have shaded the colonnade and protected the inner rooms is totally gone and only a few of the original ceiling beams remain in place. Moreover, the frieze has been stripped from its original placement: pieces are divided among museums in Greece, France, Germany, and Denmark, but the majority is now in London at the British Museum. In these modern contexts, the blocks are displayed at eye level (Fig 1.13). In the New Acropolis Museum in Athens, the original blocks are interspersed with plaster casts. Although the New Acropolis Museum has made several curatorial choices that mimic the blocks' original placement, including rotating the entire gallery so that it sits on axis with the Parthenon (Fig 1.14), and displaying the frieze blocks in conjunction with the metopes, it displays the frieze blocks at a comfortable eye level, and their installation in the concrete and steel gallery does little to evoke the ancient context for which the blocks were intended (Figure 1.15). Despite museums' best attempts to convey what the blocks looked like, they do not recreate the original viewing conditions of the Parthenon Frieze.

Techne of the Frieze

The frieze is carved in low relief, with figures emerging from the background plane of the block (Figure 1.16). Although each block was originally ca. 0.60 m. in width, there is no part of the carving that projects more than 0.056 m.[21] This technique differs drastically from that used on the metopes, which is done in such deep relief that entire limbs project from the panels. The flowing and cohesive composition of the Parthenon frieze disguises the fact that its carving and configuration includes a large amount of variability. On the longer north and south sides of the building, the carving of the horses, men, and women moves seamlessly across the boundaries of the blocks, the joins between blocks bisecting horses or chariots (Fig 1.17). In contrast, the carving of the blocks on the eastern and western sides of the frieze does appear to respect the

---

[21] Neils, 2006, 33.

joins of the blocks. Groups of humans and animals fit neatly within the confines of the rectangular space and only small features such as hooves or tails cross over the joins between two blocks (Fig 1.18).[22]

The eastern and western sides of the frieze (which both respect the joins), are also technically different. The blocks of the western side are mostly uniform in length. Three frieze blocks equal the length of one longer architrave block; the joins of the smaller frieze blocks are staggered with the joins of the architrave blocks below. The east side however, does not have uniform lengths of blocks, and the irregular lengths of the blocks do not allow them to rest neatly on the architrave in the 3:1 relationship of the west side. J. J. Coulton has interpreted the varying lengths of the blocks to mean that they were each cut to fit the previously planned composition.[23]

The artists of the frieze were particularly aware of the viewing limitations of the high placement on the exterior of the cella as evidenced by technical choices in the carving. The first of these choices is the previously mentioned shallow relief carving. The placement of the panels dictates that they would normally be seen only in diffuse light, as the ceiling of the pteroma shaded the course where the blocks rested. Thus, shadows cast by deep recesses and projecting elements of high relief carving (such as that of the metopes) would not lend to the legibility of the frieze, but rather cast shadow upon itself, obfuscating the carving. The shallow relief that the artist used is much more appropriate, as it conveys depth without causing the work to obscure itself.

In an even more sophisticated touch, the shallow relief itself is not uniform in depth, but rather is carved deeper near the top of the blocks and more shallowly at the base.[24] Many

---

[22] Coulton 1976, 70.
[23] Coulton 1976, 72.
[24] Marconi, 2009, 161.

scholars have said that this carving causes the panels to incline slightly towards the viewer, which is not the case.[25] Instead, the foremost plane of the carving maintains a right angle to the base of the block, so although the top has deeper carving it does not "project" out further. Marconi noticed that the carving is at its deepest and most prominent around the heads of men and animals, areas that would have been important parts of the viewer's "reading" process when looking at the narrative of the procession.

There is disagreement as to where the frieze blocks were carved. Brommer believes that they must have all been carved on the ground and then hoisted into place. Dinsmoor, Jenkins, and Korres, believe the opposite, that all the frieze blocks were carved in situ. Korres cites the small gap or "guide strip" at the bottom and top of each of the frieze blocks, which was perhaps meant to accommodate the angle needed for a hammer and chisel to be used on the blocks (Fig 1.19). This additional gap would be needed to accommodate for the ceiling beams and architrave which would impede the sculptor's ability to carve freely.[26] However, Ashmole, Palagia, and Coulton have all argued for the north and south sides being carved in situ, while the east and west sides were carved on the ground. Regardless of where the blocks were originally carved, they must have all been painted in situ by artists working on scaffolding as paint was needed to disguise the joins between the blocks.[27]

Aside from the logistics of installation and painting, it is clear that the artists of the Parthenon frieze were faced with an enormous challenge – to depict overlapping bodies, chariots, and horses (sometimes as many as eight horses and riders at a time) layered in less than six centimeters of marble, a width shorter than a person's thumb. The Greek sculptors made a

---

[25] Marconi, 2009, 161.
[26] Korres, 1994, 91.
[27] Coulton, 1976, 70.

number of concessions in order to meet visual expectations. One such accommodation can be seen in the height of the figures. The archaic and classical Greek standard in linear composition was isocephaly[28] - the practice of framing figures so that all of them rise to the full height of the frieze. The implementation of isocephaly was difficult on the Parthenon Frieze, which features riders, walking figures, and seated gods within the same narrative band (Figure 1.20). The sculptors reduced the sizes of the horses in order for the seated riders not to tower over their normal standing counterparts. Although this is clearly noticeable when examining the sizes of the horses and riders individually, it allows for harmonious composition that fits together in such a way that this adjustment is not glaring when viewing the whole. Similarly, in the case of the depiction of the twelve gods of the Olympian Pantheon, by displaying the figures as seated or reclining, the sculptors allowed for the much more important Olympians to be one third larger than the Athenian worshippers (Figure 1.21).

Another design challenge successfully overcome by the sculptors was avoiding a monotonous composition. With such a long space decorated with figures performing a limited number of actions, the sculptors had to be innovative in deriving an interesting arrangement that would hold the viewers' attention. The different viewing processes of simple linear procession versus dense groups of overlapping figures is one solution to the problem, as the viewer has to "work" harder to read more complex groupings. The uneven spacing of the figures also lends interest and variety to the speed at which the artistic narrative progresses. Jenifer Neils argues that the procession very subtly utilizes a simple a-b-a type formula in the design where animals alternate from walking, to racing, to walking again, seen in both the sacrificial cattle and the

[28] Neils, 2006, 48.

horsemen.[29] She also identifies the standing marshals as a device that slows the movement of the frieze, the sporadic visual equivalent of a musical ritardando which lends emphasis and delineation within the composition. On the northwest and southwest corners of the frieze, the marshal on block WI stands frontally but faces the oncoming line of riders (Fig 1.22). Otherwise, the marshals face in the opposite direction of the procession.

The "Paradox" of the Parthenon Frieze

The "Parthenon Paradox" idea was set forth by scholars such as Bernard Ashmole and A.W. Lawrence in the 1970s.[30] They considered the placement of the frieze on the outer wall of the cella to be illogical. Ashmole went far enough to say that "an ancient Greek stranger coming for the first time to Acropolis in Athens and looking up at the sculptural decoration of the Parthenon might well have been excused for believing that its architect had taken leave of his senses."[31] Both Ashmole and Lawrence were so baffled by the choice of placement that they argued that it must have been a purposeful display of opulence. They proposed that the frieze's limited visibility was meant to demonstrate the inexhaustible resources of Periclean Athens, a city that could use tribute paid by weaker allies to fund a nearly invisible artistic endeavor.[32] When a masterpiece is not meant to be seen clearly, it could only be motivated by "a kind of artistic hubris" Ashmole concluded.[33]

Scholars have, for the most part, maintained the negative view of the placement put forth by Ashmole and Lawrence. Jenkins writes that the "frieze could be viewed only in snatches through the peristyle, and this position for so great a work must be called inconspicuous if not

[29] Neils, 2006, 48.
[30] Osborne, 1987, 98.
[31] Ashmole, 1972, 118.
[32] Lawrence, 1972, 139.
[33] Ashmole, 1972, 118.

obscure."[34] In 1987, Robin Osborne called the placement of the frieze "perverse."[35] However, Osborne recognized that the placement of the frieze and the punctuation in viewing caused by the columns in front of it would have some deeper "implications for the relationship between the viewer and the frieze." He writes

> While the sculptures of the pediments and metopes display themselves to a passive viewer as created objects upon which to gaze, the sculpture of the frieze engages the viewer in an active capacity: the viewer actually creates what he or she sees by the position which he or she adopts…The viewer is thus involved in the creation of the frieze in a way that s/he would not be if the frieze were not so "perversely" placed.[36]

Osborne thought of the frieze's positioning as less than ideal, but also felt as if the figures would be visible enough to form a special connection to the viewer. Osborne's idea of the frieze's degree of visibility paralleled that of Hölscher, who wrote

> "[viewers] could have concluded from the general context that the scene shown was the Panathenaic procession. But the conditions of observation certainly did not allow a viewer to identify, say, ten groups of horsemen differentiated only by minor variations of clothing or attributes."[37]

Clemente Marconi felt that Osborne's analysis, which included visitor participation with the frieze presumed a higher degree of visibility than was possible, writing that "suggestions like those by Stillwell and Osborne reveal a certain sense of unease in dealing with the original, fragmented view of the Parthenon frieze."[38] Marconi reiterated the concern of previous historians that, when combined, factors such as the size of the figures, distortion, low light in the pteroma, and the obstruction of the columns, would make a good view of the Parthenon Frieze impossible.[39]

---

[34] Jenkins, 2006, 95.
[35] Osborne, 1987, 98.
[36] Osborne, 1987, 110.
[37] Holscher, 2009, 54 -55.
[38] Marconi, 2009, 164.
[39] Marconi, 2009, 159.

> Few figural decorations of ancient Greek buildings were positioned under more unfavorable viewing conditions from the ground than the Parthenon frieze; yet few of them can rival the sophisticated variety and richness of the treatment it reveals.[40]

The second half of this statement is true: the Parthenon frieze is unrivalled in its complexity and narrative strategy on other monumental architectural sculpture (with the possible exception of the Great Altar at Pergamon) until the time of Trajan. Yet the first claim, which follows in the footsteps of earlier historians and places the frieze within a zone of visual obscurity, can be questioned, as will be argued below.

In 1936, Gorham Phillips Stevens accepted that there were limitations in viewing the frieze, but recognized that the western double staircase and platform that led up to the temple would be the ideal places to view the composition (Fig 1.23).[41] Building off this idea, Richard Stillwell used a monochrome white model to attempt to understand how spectators viewed the Parthenon frieze. He located an ideal "viewing band" that ran around the building, about 30 feet from the stylobate.[42] Stillwell used a model to demonstrate that viewing the Parthenon frieze was possible, albeit made more difficult by the interruptions of columns, ceiling beams, and the high placement on the building (Fig 1.24). While acknowledging a certain level of visibility Tonio Hölscher maintains

> Experiments seem to have shown that even under these difficult conditions many details of high-up positioned architectural sculpture could be distinguished; the original colours would have also increased visibility. Be that as it may… it is hard to avoid the conclusion that the traditional placing of architectural decoration in metopes, friezes, and pediments was not very helpful for intensive viewing.[43]

Despite his acknowledgement of the importance of color, Hölscher maintained the traditional view that the architectural sculpture of Classical Greek buildings was not placed in

---

[40] Marconi, 2009, 158.
[41] Stevens 1936, 481.
[42] Stillwell, 1969, 233.
[43] Holscher, 2009, 56.

zones of optimum visibility, writing “friezes were even placed within and behind the colonnade where they were obscured ,indeed, almost concealed, from sight by the shadow of the roof.”[44] .Hölscher argued that even the metopal and pedimental sculptural programs would have required the viewer to make multiple inconvenient trips around the building to comprehend them fully.[45] Yet Hölscher did not test his claim that “architectural sculpture never corresponds with the functional spaces of the buildings.” Hölscher also maintained that “pathways of dynamic movement” (ie. the Panathenaic procession that runs along the north side of the Parthenon) are not conducive to viewing, but did not test this assertion.

Marconi also recognizes that color was present on the frieze, but largely downplays the idea that color could be the solution to problems of visibility. Though he acknowledges that traces of paint have been found on the Parthenon and contemporary sculptures, he believes that “given the nature of the evidence, these suggestions [for polychromatic sculptures] are purely hypothetical”[46] In the following chapter, this study will seek to prove otherwise. Marconi’s statement that “even if the frieze were fully colored, its polychromy mainly served to compensate for the shallow depth of the reliefs and for the continuous overlapping of the figures” minimizes the role of color but actually goes to the heart of the clarifying power of polychromy.

Refinements in the carving of the frieze would have lent clarity, but the improvements in legibility due to these minute changes in the carving pale in comparison to the effect that color must have had on the viewer’s ability to distinguish the many parts of the composition (Fig 1.25). Yet 20th and 21st century scholars have largely deemphasize the role of color, framing its

[44] Holscher, 2009, 54.
[45] Holscher, 2009, 55.
[46] Marconi, 2009, 162.

use as subsidiary to the line and form of the carving and deeming it at best a final touch or an augmentation. This designation will be called into question through an examination of color and its role on the Parthenon.

Chapter Two: The Effect of Color

> Grey Gothic and white Classic do not wholly satisfy. Calvinistic whitewash and Renaissance plaster peel from Medieval walls, disclosing the faded films of once-splendid color, and long-buried fragments of fallen Hellenic temples expose the startling evidence of polychrome decoration on what were long held to be (and so copied) snow pure fanes
>
> Leon V. Solon
>
> *Polychromy*, 1924, page viii

Color is the factor that scholars do not adequately consider when they write about the "viewing problem" of the Parthenon frieze. Just as form, highlight, and shadow would have played into the viewing experience, color would have affected the duration, manner, and extent of the viewer's interaction with the Ionic frieze. A composition that many believed to be shadowed or murky in the covered space would have been brightened and highlighted with a diverse palette, and the discussion of that polychromy is both useful and necessary in imagining the building as it originally stood. However, discussion of color on the Parthenon frieze is difficult for two reasons: the scant evidence, and the problems with previous interpretations of the limited extant color. Contemporary biases made the earliest study of color on the Parthenon unreliable and unscientific and even now, scholars are challenged by this legacy.

However, advances in technology are making significant changes to the study of polychromy. The analysis of differential weathering "ghost images," infrared and macro-photography, raking-light views, microscopy, and ultraviolet fluorescence have yielded surprising results from blocks which were previously thought to contain no extant traces of color. This chapter will review the history of the study of ancient color, examine the evidence for color on the Parthenon, and explore the effects of this strategic use of color on a visitor to the temple.

19th and 20th Century Perceptions of Ancient Color

Interest in ancient polychromy intensified after the rediscovery of the Roman cities of Pompeii and Herculaneum, filled with brightly frescoed rooms, in middle of the eighteenth century (Fig 2.1). The first published observations of color on ancient architecture were made by two Englishmen, J. Stuart and N. Revett, in their first volume of the *Antiquities of Athens*, published in 1762.[47] The study of ancient polychromy was enthusiastically adopted by the French soon after. French antiquarian and artist Antoine-Chrysostome Quatremère de Quincy was one of the first to take ancient written sources on painted sculpture seriously. He merged this information with the less informed but more prevalent neo-classical doctrine concerning color in his 1814 reconstruction drawings of "Le Jupiter Olympien" (Fig 2.2).[48] Although Quatremère de Quincy never broached the subject of the pigmentation of the Parthenon frieze, his work paved the way for the 1830 reconstruction of the painted stucco relief of the western pediment of the temple of Aphaia. Although this reconstruction was heavily influenced by contemporary aesthetics, the color choices were partially informed by the recorded observations on extant color by diplomats and architects who had visited the temple of Aphaia at Aegina (Fig 2.3).

1830 was also the year that the German scholar Jacob Ignaz Hittorf first published his research including a systematical description of ancient polychromy.[49] A follower of Quatremère de Quincy, Hittorf travelled to Sicily on an expedition from 1823-1824.[50] There, he took interest in a small Doric temple at the site of Selinus with preserved traces of colored wall plaster. We now know this building as Temple B, a Hellenistic temple built at the time that Selinus was

---

[47] Stuart and Revett, 1762, 65.
[48] Quatremere de Quincy, 1815, 458
[49] Hittorff, 1851, 473.
[50] Jenkins and Middleton, 1990, 183.

under Carthaginian control.[51] Hittorf produced a series of lovely, albeit notional, hand painted reconstructions, favoring a balance of yellow, red, and blue (Fig 2.4).[52] Inspired by Hittorf's work, the German architect Gottfried Semper also travelled to Sicily, where he visited the same sites. Semper became convinced that not only was Hittorf correct in his use of overarching architectural color schemes; his reconstructions were actually too pale. Semper went on to produce even more dramatic colored reconstructions.[53]

Hittorf and Semper's work caused a stir within the French Académie des Beaux Arts and the Académie des Inscriptions et Belles-Lettres. Advances in the field of archaeology and new discoveries were arousing public interest in the subject matter of ancient polychromy.[54] At the same time major innovations were made in the technique of color printing. For the first time, large numbers of colored reproductions could be produced and circulated at a low cost, promoting an interest in architectural polychromy across Europe.[55]

There was, however, a backlash from scholars such as French archaeologist and philologist Desiré Raoul-Rochette, who maintained that buildings could not have been colored, despite the seemingly indisputable evidence.[56] Ironically, much of the stigma against the idea of brightly painted ancient statuary came from a mistaken belief that had its genesis in the 15th and 16th centuries. The misreading of ancient sculpture in the Renaissance and the perpetuation of the idea of a pristine white classical art in the Neoclassical and Greek Revival movements ultimately trained Western viewers to reject the authenticity of ancient polychromy. The fact that

[51] Van Zantan, 1994, 268- 269.
[52] Prater, 2008, 34.
[53] Semper, 1834, 18.
[54] Ridgway, 1999, 106.
[55] Korres, 1999, 174.
[56] Sisa, 1990, 439.

Michelangelo and Canova carved their masterpieces in pure unadorned marble led the Western viewer to think of white as "right."[57] (Fig 2.5)

This stigma also occurred in architectural terms, particularly for residents of the United Kingdom and the United States, where buildings are often designed in the Greek Revival style – buildings described by Brunilde Rigway as "lofty pediments filled with completely white images against a white background, which our eye meets with automatic recognition, if not with aesthetic appreciation."[58]

Other art historians such as Johann Joachim Winckelmann claimed that the "barbaric custom of painting marble and stone" must have only occurred in early or lesser sculptures. In his 1764 "History of the Art of Antiquity," Winckelmann wrote, "Since it is white that reflects the most light, it consequently is more sensitive; hence a beautiful body will be the more beautiful the whiter it is."[59]

Soon arguments arose between "monochromists" and "polychromists" and those who disagreed on the limitations of polychromy. Most had never seen the extant paint traces present on the ancient monuments. At one point, the archaeologist Charles Newton was so frustrated by the public's disbelief in his reports of surviving color he was sending back from Turkey that he scraped blue pigment off of a marble piece from the Mausoleum at Halicarnassus and bottled it as proof (Fig 2.6) .[60] Early archaeologists also struggled to display the traces of color they had found because of the fugitive nature of the paint, which often began to fade as soon as it was exposed to oxygen.[61] Often, even when the presence of polychromy was acknowledged, it was

---

[57] Brinkmann, 2008, 18.
[58] Ridgway, 1999, 104.
[59] Siebler and Wolf, 2007, 23.
[60] Jenkins, 2007, 38.
[61] Jenkins, 2007, 40.

dismissed or characterized as bizarre. In 1817, Johann Martin von Wagner, the art agent to King Ludwig I wrote:

> It may appear striking and strange to our modern taste to see marble statues that were partially painted in their complete design, as well as hearing about temples that were painted inside and out and whose ornamentations were indicated in many colours…"[62]

Naturally, this controversy about ancient polychromy was also directed towards the most famous building of the Greek world – the Parthenon (Fig 2.7). The French architect Alexis Paccard published a series of watercolors depicting his ideal notion of the Parthenon in a Louis Philippe style color scheme of pale blues, pinks, and yellows (Fig 2.8).[63] In 1836 and 1837 a committee comprised of architects, painters, and scientists was appointed by the trustees of the British Museum to examine the Parthenon marbles for paint traces. During one of the three meetings, its members were even joined by Hittorf. However, the results of the meetings were not conclusive. Although chemical analysis revealed that pigment bound in some "vegetable substance" was present, the hue and application method was indeterminable and contradicting ideas on the weathering of the blocks and patina remained unresolved.[64] The inconclusive results of the committee hearings caused the Elgin Marbles to fade from the discussion of ancient color use for about 150 years.

At the same time, the entire study of polychromy became less valued. As the discipline of archaeology became more scientific, it became apparent that the whimsical colored reconstructions of the Académie artists in which "imagination and interpretation were prized above accuracy and objectivity" could not be trusted.[65] By the early 20th century color on ancient

---

[62] Siebler and Wolf, 2007, 25.
[63] Prater, 2008, 35.
[64] Jenkins and Middleton, 1990, 186.
[65] Ridgway, 1999, 106.

architecture was no longer an urgent topic.[66] The decreasing status of polychromy studies was reinforced after the Second World War. After the havoc wrought on Europe, modernist art historians and archaeologists turned to a formal-aesthetic approach to Greek art and architecture where polychromy was not denied, but rather, simply ignored.[67]

One major flaw in the early studies of polychromy was the conflation of contemporary art theory with the practice of ancient painting. In their fantastical reconstructions of colored ancient buildings, 19th century artists did not closely observe the actual materials or techniques used by ancient painters. This attitude that understanding ancient artistic process and materials mattered little lasted well into the 20th century.

However, the literary and archaeological evidence for color on the Parthenon no longer allows our aesthetic preferences to dictate our study (or denial) of ancient polychromy. In examining the evidence, it should be clear that the question is no longer “was the Parthenon painted?” but rather, “where?”, “to what degree?” and “in what colors?”

Literary Evidence for Polychromy on Classical Sculpture

One challenge to the study of ancient architectural polychromy, particularly that of the Parthenon, is the lack of ancient literary sources on the subject. Brief references to architectural painting occur in earlier authors such as Theophrastus[68] and Xenophon,[69] but these men lived after the time of Phidias and his team of sculptors and the information they provide is not substantial enough to make large claims about the process of painting on architectural sculpture.

---

[66] Ridgway, 1999, 106.
[67] Siebler and Wolf, 2007, 24.
[68] Theophrastus, On Stones, 55, 1-12.
[69] Xenophon, Hellenica, VII, 1-8.

Greek ideas on color can be found in scientific treatises by authors such as Empedocles and Diogenes.[70] The Pythagorean philosophers believed that colors of red, black, white and yellow were associated with the four primary elements.[71] We also hear of color being used in clothing and objects from authors such as Aristotle, who describes how the staffs of participants in early democracy were "color coded" to match their court assignments.[72] Color was used by 5th century armies and navies, both Greek and "barbarian."[73] Theophrastus wrote extensively on the various colors of stones, a topic which would later be re-explored by Pliny (see discussion of pigments later in chapter). Vitruvius also discusses pigments in the context of Roman wall painting.[74] We hear of wall paintings by 5th century artists such as Agatharchus, Ploygnotos, Mikon, Panainos, and Apollodorus who experimented with shading and contour, but we do not have textual records of the particular colors that they used.[75]

There are virtually no ancient descriptions of color on architectural sculpture of the Classical period. However, there is textual evidence for painting on sculpture in the same period. One particularly interesting example comes from Pliny the Elder's *Histories*. There he writes about classical sculptor Praxiteles:

> *Hic est Nicias de quo dicebat Praxiteles interrogatus, quae maxime opera sua probaret in marmoribus: "quibus Nicias manum admovisset" – tantum* ***circumlitioni*** *eius tribuebat.*[76]
>
> It is this Nicias of whom Praxiteles used to say, when asked which of his own works in marble he regarded most highly, "the ones to which Nikias has set his hand" – so much value did he assign to the latter's *circumlitio*.[77]

[70] Pandermalis, 2012, 4.
[71] Pandermalis, 2012, 4.
[72] Aristotle, Constitution, 65.
[73] Aeschylus, Persians 558.
[74] Vitruvius, De Architectura, 7.4.4 – 7.5.14.
[75] Pollitt, 1990, 141 – 145.
[76] Pliny, Naturalis historia 35, 133.

The meaning behind Pliny's word *circumlitio* has been debated by scholars. The Latin word linere has two meanings, either a "smearing or spreading over" or the more specialized "overlaying of color, the tint or hue given to marble by rubbing it with a mixture of oil and wax."[78] Winkelmann adopted the first meaning in his interpretation of the passage by Pliny, writing that

> [Nikias] can be of assistance to him with his model, and I believe that circumlitio signifies the act of going over a model and re-touching it … in making such improvement, clay is laid on and smoothed off here and there which is termed linere.[79]

However, most scholars now believe that Pliny was actually using the term linere in its second sense, the "overlaying of color." Whether this was a subdued tinting and veneering of the marble as 18th century scholars have suggested, or a full blown application of many layers of pigment to the marble, as current scholars now believe, the passage certainly indicates the addition of color rather than form to the works of the sculptor.

Praxiteles was active in Athens from approximately 375 – 340 BC, roughly a century later than Phidias.[80] Praxiteles evidently did not find the addition of paint to his sculptures to be a simple augmentation, but rather a valuable addition, commenting that of the sculptures he had rendered in marble, his favorites were those then painted by the master Nikias. Pliny also tells us that the sculptor's Knidian Aphrodite was one of these sculptures painted by Nikias.[81]

Epigraphical proof that the buildings of on the Athenian Acropolis did include painted details comes in the accounts for the Erechtheion:

---

77 Primavesi, 2008, 25.
78 Lewis and Short, Latin Dictionary
79 Winckelmann, trans: Mallgrave, History of the Art of Antiquity VII, 222.
80 The Getty Museum, 2013, online.
81 Palagia, 1999, 99.

> (Line 25) For erecting scaffolding for the painters in encaustic, in the interior, below the ceiling, to Manis living in Kollytos: 1 drachma, 3 obols.
>
> (line 46) To the painters in encaustic, for painting the cymatium on the inner face of the epistyle, at five obols per foot…[82]

Line 25 is particularly valuable in that it shows that shaded spaces on the Erechthieon were decorated with paint. Although ancient authors do not dwell on it, 5th century polychromy is clearly documented on archaeological artifacts and architecture. Thus, the study of ancient color has not revolved around literary evidence, but rather the scant but crucial extant remains of color on ancient structures.

Evidence for Polychromy on the Parthenon

Evidence of color is actually preserved on building elements of the Parthenon, and the Hephaisteion, a contemporary building that preserves a large amount of paint. In 1989, The Greek Antiquities Service conducted a study on the polychromy of architectural elements such as the geisia, metopes, and triglyphs. Blue was found on the fillets and triglyphs. Green and red pigments were found on the antae capitals.[83] The alternation of the blue trigylphs with the red backgrounds of the metopes (discussed below) would have reinforced the rhythm of the building's exterior.

Of the three types of architectural sculpture on the Parthenon, the pedimental sculpture is the most informative in terms of pigment. Ian Jenkins has written on the only well-preserved original paint from the Parthenon sculptures in the British Museum: a dark brush stroke which is preserved on the back of the seat of Figure F (identified as Demeter) on the east pediment (Fig 2.9). The brushstroke would not have been visible when the sculpture was in place on the

---

[82] Pollitt, 1990, 192.
[83] Vlassopoulou, 2008, 220.

pediment, indicating that it may have been a kind of "test strip."[84] In Athens in 2009, the conservators at the New Acropolis Museum detected monochromatic layers of paint on the Kekrops and Pandrosos group from the west pediment. They found blue pigment in the folds of a himation along with the orange-brown "patina," which is still the subject of debate among archaeologists and art historians.[85] In 1967 Frank Brommer studied the Parthenon's metopes in detail and argued for a red background based on the presence of red paint on five of the metopes from the west side.[86] It is noteworthy that the background of the metopes on the contemporary Hephaisteion have been shown to have been red also.[87]

Despite its more sheltered position on the building, the paint on the frieze blocks has not fared any better than that of the pediments or metopes. Due to the natural effects of post-antique exposure and weathering, most color was effaced by the time the marble slabs were originally brought to the British Museum by Lord Elgin in 1801-1802.[88] Inconclusive studies on the chemical analysis of the pigment were conducted in 1854, before the notorious cleaning of some of the blocks in 1937-1938 removed much of the orange-brown patina that covered the sculptures. Presumably, this cleaning could have taken some surviving paint traces with it. However, recent studies have taken place in both Athens and London regarding paint on the frieze blocks.[89] These analyses reveal the presence of titaniferous copper oxide (to create blue), iron oxides including haematite (used for both red and yellow), lead (for white), and carbon (for black).[90] In Athens Greek scholars and conservators began their examination of color on the

---

[84] Jenkins, 2007, 43.
[85] Vlassopoulou, 2008, 222.
[86] Brommer, 1967, 159.
[87] Brommer, 1977, 209.
[88] Hitchens, 1987, 31.
[89] Jenkins and Middleton, 1988, 185.
[90] Kakoulli, 2009, 12.

Parthenon frieze blocks when they were removed from the original building in 1992-1993. These studies took place while the blocks were being conserved in order to remove the soot that had accumulated on their surface. During this process, “monochromatic layers” or “patina layers” were uncovered but the treatment of the blocks resulted in the discovery of several remnants of color. A pale green paint was found in the himation of a rider. A bluish hue was found on the chitoniskos of another figure.[91]

Recently, Greek scientists Skoulikidis, Papkonstantinou, Dogani, and Galanou have detected the presence of Egyptian Blue on the west frieze of the Parthenon.[92] It has also been found on figures from both pediments: Iris on the west side, and two goddesses from the east. The recent detections of Egyptian blue was possible do to the fact that the synthetic pigment has an unique luminescence – it emits infrared light when it is put under red light (Fig 2.10). This property allows it to be easily detected using a simple night vision camera in a dark room. The pigment can break into sheets as thin as 1 billionth of a meter thick. This is advantageous for archeologists on the hunt for color, as even the tiniest layer of preserved Egyptian blue is detectable.[93] These recent results, though limited, make significant contributions to reconstructing the original color of the classical frieze. However, they do not tell us how the pigment was applied, handled, or modeled.

Other examples of Classical Color

Recent scientific investigations have provided insight on the color of other classical marble sculpture contemporary with the Parthenon. The torso of a cuirassed archer now in the Acropolis Museum, 57 cm in height, was carved around 460 BC (Figure 2.11). The archer would

---

[91] Vlassopoulou, 2008, 220.
[92] Katsaros, 2012, 23.
[93] Inside Science, 2013, online.

have used his right hand to draw the string of a bow across his body. He wears a short chiton and a muscle cuirass.[94] The sculpture includes incised outlines of the garment's ornamentation.[95] Based on UV and infrared scanning, Brinkmann has restored the cuirass as yellow or gold; a horizontal row of leaves on the chiton has been colored red and blue.[96] Riders depicted in the Parthenon frieze's procession wear similar cuirasses.

Another informative piece is a slightly over life size female head in Copenhagen (Fig 2.12), dated on stylistic grounds to ca. 425 BC although it is possible that it was reworked in Roman period.[97] The piece includes drill holes in the hair for the attachment of metal ornaments such as wreaths, indicating that it may be a goddess. Paint is preserved in the right eye and under the left eye. There are faint traces under the right eye of flesh tone.[98] Ultraviolet fluorescence revealed further detail of the eyes and face.

Results from the studies of the torso in Athens and the Copenhagen head are informative but not sizeable enough to make generalizations about Classical polychromy as a whole. The dates of the torso and head bracket that of the Parthenon frieze, but do not overlap it. Furthermore, both pieces are in the round and therefore their coloring patterns may not necessarily be applicable to the frieze. As the Copenhagen Polychromy Network writes on its website: "no conclusions can be drawn at this point as to whether the polychromy of classical reliefs differed from that of sculptures in the round: far too few sculptures in the round of the Classical period have so far been examined in-depth with the technology now available."[99]

---

[94] Pandermalis, 2012, 54.
[95] Ostergaard, 2008, 89
[96] Pandermalis, 2012, 54.
[97] Ostergaard, Circumlitio, 89
[98] Copenhagen Polychromy Network, 2011, online.
[99] Copenhagen Polychromy Network, 2011, online.

Considering the limitations in studying Classical polychromy, it makes sense then, for archaeologists to examine the periods before and after the time of the Parthenon to see if any evolutionary trends in painting are apparent. Of course, finding these trends has its own challenges. As Ioanna Kakoulli writes:

> The survival of painted schemes from the Mycenaean to the Classical Period is patchy, and rarely forms a coherent sequence. The evolution of pictorial means … the use of shading, three-dimensionality, spatial perspective, transparent paint layers, metal attachments and gilding – cannot be discussed as parts of a progressive or sequential development.[100]

This lack of continuous chronology is problematic. However, it is still worthwhile to place Classical sculpture within a larger framework of Greek color, including Archaic and Hellenistic examples in an effort to gain a more complete understanding of the role of color in Greek architectural sculpture.

Archaic Color

Polychromy is best documented in the Archaic period, and indeed, many Archaic and Early Classical buildings preserve brightly colored elements.[101] Preservation conditions were better for archaic buildings such as the Temple of Aphaia on Aegina and the Siphnian Treasury at Delphi than those of the Periclean Acropolis. Archaic polychromy is most easily characterized by two traits. The first is the non-naturalistic use of color including green horses, and blue and orange lions.[102] The second is "local" color, meaning that the color is applied in uniform swaths and does not include modeling or shading (Fig 2.13). This uniformity of paint application in the Archaic period is also more conducive to preservation. Rather than the layering and complex washes of the Hellenistic period, Archaic decoration was often incised and then painted in thick

[100] Kakoulli, 2009, 5.
[101] Brinkmann, 2008, 24.
[102] Ridgway, 1999, 133.

layers of pigment without underpainting.[103] This older and less sophisticated method allowed for pigment or its impression to endure, often quite successfully. The architectural fragments from Aegina and the Hekatompedon Pediment in Athens preserve traces of vibrant reds, greens, and blues (Fig 2.14).

Similarly, there are many well preserved figural sculptures from the Archaic period where color is preserved on the clothes, hair, and facial features. Recently, the New Acropolis Museum has made a special study of nineteen Archaic marble sculptures in their collection which preserve a high degree of their original pigmentation. The majority of these sculptures are korai: life-sized figural depictions of women wearing a peplos or chiton and himation.[104] Many of these garments preserve beautiful meander or floral patterns (Fig 2.15). The sculptures have been examined both visually and with a variety of scanning methods. One of the most interesting cases has proved to be that of the Peplos Kore, which dates to about 530 BC. Extant pigment tells us that her hair was red or brown, facial features such as pupils, eyelids, and eyebrows were outlined in black paint. She wore a green and blue chiton, which originally included a band decorated with animals, birds and horsemen. Her garment features spiral, floral, and helices along the hems and edges.[105] Vincenz Brinkmann has created multiple reconstructions of this statue to illustrate different possible color schemes which range from limited accentuation of features and garment details to an entirely painted statue[106] (Fig 2.16).

As compelling as these brightly colored archaic statues may be, they do not correspond directly to the painting methods of their Classical descendents. Changes in the sophistication of vase painting from the Late Archaic to the Classical period indicate a notable maturation in the

---

[103] Ostergaard, 2008, 89.
[104] Pandermalis, 2012, 15.
[105] Pandermalis, 2012, 28.
[106] Brinkmann, 2008, 24.

Greek artist's interest in form and shadow. This development is illustrated by ceramic works such as a famous white ground lekythos in the National Archaeological Museum in Athens by the Achilles Painter that depicts a warrior "taking leave of his wife" (Fig 2.17). This vase, which is contemporary with the carving and painting of the Parthenon frieze, illustrates a refined understanding of foreshortening and color modulation.[107] Even more advanced, are fragments by the same painter from a red figure calyx-krater, depicting the battle between the Olympian Gods and Giants, now in the Michael C. Carlos Museum in Atlanta (2002.043.060). Earlier than the Parthenon frieze, the fragments demonstrate sophisticated shading to the point of illusionism (Fig 2.18).[108] Scholars have extrapolated that a similar level of mimesis and illusionism had been achieved in monumental wall painting.[109] It is hard to believe that the painters of sculpture were not working at a similarly advanced level – one that contrasts drastically from the local and saturated colors of Archaic sculptural polychromy.

Late Classical Color

Looking at the strategic use of color in the years immediately following the construction of the Parthenon is also helpful in contextualizing polychromy. Funeral stelai and sarcophagi can be very useful in this regard. Extant paint on architectonic sarcophagi of the Late Classical period such as the so-called Mourning Woman Sarcophagus in the Istanbul Archaeological Museum or the Alexander Sarcophagus, which dates to about 320 BC, include highly advanced effects.[110] The sculpture on the Alexander sarcophagus features nuances and shading on top of the high relief, creating illusionistic depth and complexity (Fig 2.19).[111]

---

[107] Oakley, 2004, 62.
[108] Michael C. Carlos Museum, 2013, online.
[109] Smith and Plantzos, 2012, 8.3, online.
[110] Ridgway, 1999, 119.
[111] Ostergaard, 2008, 93.

Studying the decorative use of colored stones in buildings can also affirm assumptions about the use of painted color on architecture. Classical monuments such as the Propylaia (ca. 430 BC), the Erechtheion (completed 406 BC), and the late classical Mausoleum of Halikarnassos (ca. 350 BC) and the Choregic Monument of Lysikrates (335 BC), use colored stones on exterior architecture. For the frieze of the Erechtheion, figures were carved in high relief in white Pentelic marble, the same marble that was used in the Parthenon. However, the figures were then attached to a dark blue Eleusinian limestone background.[112] This use of blue stone, along with preserved blue paint on the background of the Hephaisteon's frieze, supports the idea that the Parthenon's Ionic frieze most likely had a blue background. The Lysikrates monument includes a yellow limestone podium with a crowning molding in bluish Hymettian marble. The tholos is white Pentelic marble, interspersed with blue stone intercolumnations.[113] The Mausoleum also used at least five varieties of stones (Fig 2.20).[114] The Propylaia also uses various colored stones, Hymettian marble, conglomerate, and poros.[115]

Kerch style vases also enrich our understanding of clothing color (Fig 2.21). A vase in the Getty, attributed to the Painter of the Wedding Procession and dated to ca 360 BC, includes many shades of pigment in the clothing of the figures. Pinks, blues, and greens as well as gilding make the vase an elaborate example of late Classical color.[116]

These colorful textiles can also be found in late Classical and Hellenistic terracottas, which often preserve a large amount of pigment. One such example is an attic terracotta figurine of a woman from the middle of the 4th century who is shown holding cymbals and dancing. The

---

[112] Brouskari 1974, 152-53
[113] Ridgway, 1999, 121.
[114] Jenkins, 2006, 35.
[115] Stevens, 1946, 91.
[116] Cohen, 2006, 337.

figurine wears a blue and pink dress with floral motifs.[117] A similar pale blue with pink adornments is used to adorn the costume of Hermes on a small Boeotian terracotta Niaskos from the first half of the 4th century.[118] Pigment used for skin color is well preserved on an earlier Theban terracotta of an ephebe with a hare from the second half of the 5th century.[119]

Although very few examples of textiles from the ancient world survive, there are a few fragments that parallel the richly colored textiles seen on Kerch vase painting and terracottas. Silk fragments from the third to sixth century BC that had been traded on the silk road have been found in northwestern China. These textiles, which display Greek and Persian influence, are in brilliant hues of red, yellow, and blue and often feature complex patterns. These textiles corroborate our belief that the ancient world was a bright and colorful one.[120]

Macedonian Tombs

In determining the palette of fifth century sculptors and artists, the well-preserved pigments of Macedonian tombs provide a valuable resource, even though they were painted a century later than the Parthenon. Scholars such as Hariclia Brecoulaki, Olga Palagia, and Katerina Rhomiopoulou have recently analyzed the pigments used in Macedonian tomb painting of the late 4th century BC. Tombs at sites such as Vergina, Lefkadia, Aghios Athanassios, Thessaloniki, Serceni, and Aineia are helpful because the buried structures mimic full-scale contemporary architecture. However, unlike the marble buildings they emulate, the buried plaster tombs have survived time, weather, and human destruction.[121]

---

[117] Rohde, 1968, 19.
[118] Rohde, 1968, 19.
[119] Besques, 1994, 30.
[120] Victoria and Albert Museum Astana Fragments, 2013, online.
[121] Breckoulaki, 2006, 147.

The Tomb of the Judgment at Lefkadia, which dates to the turn of the third century, is particularly beneficial in an analysis of paint on the Parthenon, as it seems to reproduce some of the metopal sculpture of the south side of the Parthenon in a two dimensional painted form.[122] The tomb also includes a hybrid combination of Doric triglyphs and metopes topped with a three dimensional painted Ionic figural frieze (Fig 2.22). The figures on the frieze are wearing green, blue, red, and gold and appear in front of a dark blue background.[123] Also at Lefkadia, the Tomb of the Palmettes, from the first half of the third century BC, features an Ionic facade with a painted pedimental group depicting a reclining couple who face each other (Fig 2.23). They wear elaborate drapery and their himation and chiton are shaded to appear plastic. The male figure wears red and pale green while the female figure wears mauve and gold. Inside the antechamber of the tomb, a giant anthemion and lotus pattern is rendered in pinks, greens, reds, and the Egyptian blue.[124] These colors are all secondary, meaning that they would all require the blending or layering of multiple raw pigments.[125] The blue frieze backgrounds, red taenia, and multicolored clothing on both tombs confirms a pattern that argues in favor of similar color reconstructions for the Parthenon.

The Tomb at Aghios Athanassios outside of Thessonloniki, which dates to about 315 BC, is also helpful in understanding the use of color in the century after the Parthenon (Fig 2.24). Like the Tomb of the Judgment, the façade of Aghios Athanassios features a trigylph frieze, although it lacks decorated metopes. The triglyphs are painted dark blue and rest on a red taenia with red regulae and guttae. In a reversal of the layering of the Tomb of the Judgment, on the Tomb at Aghios Athenassios, an Ionic frieze band with a processional motif is painted below the

---

[122] Ridgway, 1999, 116.
[123] Breckoulaki, 2006, 147.
[124] Rhomiopoulou, 2006, 20.
[125] Rhomiopoulou, 2006, 20.

entablature. If the tomb façade is visualized as a flattened temple façade, the position of the painted band is also very similar to that of the Ionic frieze on the Parthenon.

The figures processing towards the center of the composition evoke the subject matter of the Parthenon's Ionic frieze. The reclining figures in the center of this painted frieze are reminiscent of the central scene on the east side of the Parthenon frieze, which depicts the Olympian gods watching the Panathenaic procession. It also features a dark blue background. The figures wear multicolored costumes of blue, red, purple, gold, and green and ride horses that are light brown or tan in color. The two life-sized soldiers who are depicted below on the façade are even more remarkable (Fig 2.25). Looking at the plastic rendering of the two figures bodies and cloaks, we can begin to understand the complexity of Late Classical architectural painting.[126]

The Macedonian tombs lend a greater understanding of the Late Classical Greek artists' ability to render color and form. The presence of all-white metopes on the Macedonian tombs raises new questions about the polychromy of the metopes that Brommer asserted must have been red.[127] However, the Macedonian tombs also corroborate the belief that the background of the Ionic frieze was most likely blue, and strengthen the argument that the participants of the procession most likely wore multicolored costumes in hues that were more complex than the flat basic colors of the Archaic period.

Hellenistic Polychromy

Recently, the polychromy of 65 Hellenistic marble objects from Delos have been studied using UV light, microscopy, and X ray fluorescence spectrometry.[128] These non-invasive methods have demonstrated that by the Hellenistic period, it was common to juxtapose

---

[126] Liverani, 2008, 300.
[127] Bruno, 1981, 3.
[128] Bourgeois and Jockey, 2008, 224.

traditional basic pigments (reds, browns, and yellows made from ochres) with more expensive and complex colors such as Egyptian blue or bright pinks. Gilding was also a common practice in the Hellenistic period.[129]

It is not safe to assume that later color schemes used by Hellenistic and Roman artists were applied to earlier Greek architecture.[130] However, the widespread continuation of polychromy into the Roman and Medieval period does support the case that until the Renaissance, color was the norm.

How the Parthenon was Painted

Cumulatively, archaeological evidence indicates that the architectural sculpture of the Parthenon, and the Ionic frieze in particular, was painted. From extant paint on other classical sculpture and the Macedonian tombs, some of which were painted in imitation of buildings like the Parthenon, it is fairly certain that the background would have been blue and that the figures on the composition most likely wore garments of both primary and secondary colors. Examining the ancient method of painting provides further insight as to what these colors may have originally looked like and how they were applied to the marble.

Although the results from the chemical tests on the Parthenon marbles were largely inconclusive, most scholars agree that the mode of painting for the architecture of the Parthenon was done in the encaustic method.[131] In the encaustic method pigment mixed with a binder and beeswax that is then heated and applied to the marble as a liquid. The matrix of wax, pigment, and binder then hardens into a vibrant water insoluble coating.

---

[129] Bourgeois and Jockey, 2008, 224.
[130] Abbe, 2010, 277.
[131] Pandermalis, 2012, 54.

Greek artists only used the encaustic method on elements of architecture and sculpture that were exterior or partially protected. For interior wall painting, the *buon fresco* technique was preferred. In this method, used as early as the first half of the second millennium BC by Minoan wall painters at sites such as Thera and Akrotiri (Fig 2.26),[132] pigments are painted onto a mixture of wet plaster and lime – which reacts chemically when exposed to carbon dioxide, forming a durable calcium carbonate layer. In the case of fresco, the pigment becomes part of the plaster, and therefore the structure itself. Encaustic painting pigments would have seeped into the naturally porous surface of the marble, but did not ever become incorporated with the support, which is why little ancient architectural encaustic painting is preserved in contrast to the hundreds of nearly-intact Macedonian and Roman wall paintings of the fresco method. Both the encaustic and fresco painting methods limit artists with extremely fast drying times. In the case of the fresco technique, the quickness was due to the rapid drying of the plaster on the wall. Mistakes in the fresco method were therefore, largely irreversible. Either they had to be painted over with a less durable topcoat (*fresco secco*), or the entire section of wall had to be abraded or chipped away and reworked from the beginning. Encaustic was similarly challenging due to the quick-drying nature of the wax. However, the wax could be reheated and modeled using brushes and wooden implements. This application requires a sophisticated heating system using small fires that maintain the wax at a constant temperature between melting and boiling so that pigments and binder could be mixed in before application. We can see a representation of a Greek artist applying encaustic pigment to a sculpture on an Apulian Vase in the Metropolitan Museum of Art, dated to 350-320 BC (Fig 2.27). A small brazier is included in the scene, which

---

[132] Richter, 1912, 228.

would have been used by the painter to keep the implements for applying the encaustic warm.[133] In the case of the Parthenon, the encaustic painting process was being executed by a team of artists on wooden scaffolding 40 feet above the ground. The "paint" for a large project could be prepared in advance by mixing the binder, pigment and wax and then cooling the amalgam into a small wedge or block. These blocks of paint could then be produced in mass quantities and inspected for uniformity. Thus, an artist painting the background on the eastern side of the building could be sure that he was using the exact same shade of blue as a painter on the opposite end of the Parthenon.

The pigment used by ancient artists for the encaustic method was usually naturally occurring sulphurs, oxides, and hardstones that were ground into a fine powder (Figure 2.28). Most of the information we have on the materials used for pigment comes from Theophrastus of Eresus (371-287 BC), who classified stones based on their physical properties in his treatise, *On Stones*.[134] This text was later used by Pliny in his *Natural Histories* of AD 77. By the time of Theophrastus, stones and minerals used for pigments were being imported from as far as Spain and Afghanistan.[135] Melian earth, lead, and gypsum were all used to make white pigments. Ochre and arsenic sulfide both produced yellows. Reds could be made using cinnabar (a dangerous mercuric sulfide) and miltos (rust), which was natural or created in artificial conditions. Green was derived from malachite or copper (called verdigris). Two hues of blue were often used: a deep dark blue lazurite from lapis lazuli, or a lighter blue made from copper carbonate. This light blue could occur naturally, and has been found in prehistoric sites on Cyprus. However, the blue could also be created synthetically, and "Egyptian Blue" is probably the world's first synthetic

---

[133] Metropolitan Museum of Art, 2010, online.
[134] Theophrastus, On Stones, 55, 1-12.
[135] Katsaros, 2012,18.

pigment.[136] Egyptian blue is made by combining marble powder, silicon dioxide, and metallic copper and heating the mixture to 850-1000 degrees centigrade.[137]

Ian Jenkins, who supervised the 1988 chemical study of the color remnants on the frieze, has been vocal about his vision of what kind of palette he believes was employed on the Parthenon frieze, favoring a simple contrasting color scheme of red, blue, and gold applied as leaf. He writes that by the 5th century BC, color tended to be restricted to the upper reaches of the buildings, and that contrasting color was needed to lend legibility to the moldings and sculpture.[138] However, German archaeologist Vincenz Brinkmann interprets the same evidence differently, arguing for a more refined palette with a range of colors that were mixed with white to create tonal differences. He believes that the brightly painted artifacts of the subsequent Hellenistic period were a return to the pre-classical desire for lavishness in pattern and ornamentation.[139] Brunilde Ridgway's opinion on color use in the years 480-400 BC falls somewhere between the limited palette of Jenkins and the varied one of Brinkmann. She articulates this saying "Greater naturalism in the use of colors seems apparent during this phase, although the base palette does not change; it is just used more sparingly."[140]

Examinations of ancient architectural marbles have also revealed a fortuitous feature of the encaustic method: although the color has been mostly lost, it is still determine shape and form of ancient encaustic painting on the marble's surface. This preservation occurs because the waxy coating of the encaustic paint has produced differential weathering effects (Figure 2.29). Where the marble was left unpainted, the surface weathered more quickly than where there was a

---

[136] British Museum, 2013, online.
[137] British Museum, 2013, online.
[138] Jenkins, 2007, 37.
[139] Brinkmann, 2008, 31.
[140] Ridgway, 1999, 114.

painted design, leaving "ghost images."[141] Sometimes the differences in weathering are so dramatic that they can be recognized easily, such as the preserved meander pattern of the Ionic crown-molding frieze from the Parthenon, now in the British museum. Minute traces of color and ghost images can now also be studied with the new technologies of infrared and macro-photography and raking-light views.[142] Microscopy and Ultraviolet Fluorescence can also provide information that on traces too small to be perceived by the human eye.[143] By examining these recent test results, considering "ghost images," and understanding the unique features of encaustic paint, it is possible to imagine what the process behind painting the Parthenon frieze may have been and to begin to reconstruct the ancient artist's palette. Recently, some art historians have done just that.

In order to corroborate his writings about ancient color palettes, Vincenz Brinkmann and his colleagues have created a number of replicas of famous classical statuary including color reconstructions to demonstrate what the works may have originally looked like when painted. This group of colored statuary – which includes the Parthenon pedimental figure of Hestia/Dione, has received a great deal of attention since they were published and displayed in a travelling exhibition entitled "Gods in Color: Painted Sculpture of Classical Antiquity."[144] (Figure 2.30)

Color can have a great effect on the definition and perception of ancient statuary – both freestanding and architectural. In a 2007 interview with the Wall Street Journal, Brinkmann defended his study of polychromy saying,

---

[141] Jenkins, 2007, 41.
[142] Ridgway, 1999, 114.
[143] Brinkmann, 2008, 23.
[144] Panzanelli, 2008, 14.

> Perceptual physiology hasn't changed in the last 2,000 years. Color enhances legibility tremendously. The Greeks painted the names of the figures on the friezes. You can read the names from 50 meters away. The eye has amazing powers of resolution.[145]

Although the palette of his reconstructions is debatable, Brinkmann is right in highlighting the power of color to clarify and enhance a viewer's understanding of Greek architectural sculpture.

The Importance of Color on the Parthenon Frieze

Applying large swaths of color using the encaustic method was a strategic optical device used by the architects and designers of the Parthenon to shape the viewing experience of the building. Color changes the viewers' perception of the size, shape, and form of the building, drawing certain elements out while pushing others back within a visual hierarchy. Color can be used to add an additional "punch" to the visual force of an architectural feature, or it can soften the same feature. The large-scale architectonic use of color on the building would certainly help in distinguishing the characteristic features of the temple's Doric exterior. The alternating pattern of triglyphs and metopes would be reinforced by the strong and simple use of blue and red. The subtle curves and refinements would be highlighted by the red taenia and multicolored moldings. The simple and solid forms of the Doric order were accentuated by relatively solid and basic coloring of red and blue that surely would have been striking when approaching the building through the Propylaia. As A. W. Lawrence writes on Doric polychromy:

> The whole design of a temple is a matter of contrapuntal relationships; it depends ultimately on the clear demarcation of its parts, which must be so shaped as to keep the spectator's eye continually on the move … Each line points towards one which turns at a different angle and obliges the eye to follow it: some lines, moreover, ought to be so constructed as to lead in either direction simultaneously.[146]

---

[145] Gurewitsch, 2007, online.
[146] Lawrence, 1996, 75.

Color plays an even more important role on the most famous Ionic feature of the Parthenon, the frieze.

In the transition from the bright Mediterranean sunlight striking the exterior of the Parthenon to the shaded covered space of the pteromata, the viewers' eye would have to make a series of adjustments which would be facilitated by the attention-drawing color of the Ionic frieze, bringing the eye upwards while simultaneously making the composition more legible. A blue background would recede into the shadowy space, subtly evoking the sky. Different colored horses would not only stand out from the ground plane, but also from each other. The varied horses would be accompanied by similarly differentiated riders who likely would have been filled out in flesh-tones like that of the classical female head. The light green and blue paint found on the clothing of the frieze's figures and the bright garments of the figures of the Macedonian tombs allows us to imagine how the variety of colored chitons, himations, and clamyses would have brought vibrancy and life to the figures. The well-preserved patterns on the clothing of Archaic korai hint at the possibility of sophisticated painted detail on similar garments on the frieze. Hand gestures and facial features that would have been difficult to discern in a monochrome composition would be made visible with the addition of paint. Bronze attachments of horse gear and accessories would glint, even in the ambient light. When the composition of the frieze was planned it was understood that color would clarify the overlapping of bodies and horses. This overlapping creates the ebb and flow of figures so admired by art historians. Thus we must reorient our view of color, for it was an intrinsic element of the frieze that was taken into account from the beginning.

Chapter Three: The Experiment

"Color and detail help you look longer."

"The Parthenon certainly seems to have been more colorful than I thought."

"I must say, I have a new appreciation for the craftsmanship and architectural genius behind the Parthenon."

- Participant responses from the Emory Parthenon Frieze Project
Nashville, November 10th, 2012

Visualizing the Parthenon Frieze

Advanced scanning technology and computer models do not replicate what was visible to an Athenian in the fifth century BC. However, academic and public enthusiasm for the Parthenon has resulted in some creative solutions to these problems. The Parthenon will never be complete again, but many buildings mimic its materials and design to some degree (see appendix). Its frieze blocks are not installed in a contiguous display, but plaster casts of the blocks are. The blocks are no longer displayed 40 ft from ground level, but computer models have re-installed them virtually. Color is not preserved on the original blocks, but has been hypothesized and applied on a handful of casts. Not until this year, however, has any effort been made to re-create the viewing experience of the colored Ionic frieze that is suggestive of the Parthenon itself, with the lighting conditions that would have been present in the pteroma.

In an effort to judge the visibility of the Parthenon frieze for this study, a team of Emory scholars and students created to-scale panels of six of the original frieze blocks and installed them on the west side of the Nashville Parthenon on November 10, 2012 (see appendix). These panels were painted using colors simulating ancient pigments. Five of the panels were painted on flat canvas; one of the panels was created in relief. Half of the relief panel was left white to simulate the current state of the Parthenon marbles. The panels were installed in their appropriate position on the northwest corner of the Nashville Parthenon, a full-scale replica of the Athenian temple. In doing so, the Emory team was able to approximate the original position, lighting, coloring, and content of the Parthenon frieze for visitors to the Nashville Parthenon. This viewing experience was unprecedented in the two-hundred plus year history of Parthenon scholarship. Many thanks are due to the staff of the Nashville Parthenon for allowing the experiment to take place, particularly Wesley Paine (Director) and DeeGee Lester (Education Director).

Once the panels were in place, visitors to the Nashville Parthenon were surveyed to gauge the visibility of the frieze panels in situ. Results of the experiment overwhelmingly showed that, despite the assertions of many authors, there was not a "viewing problem" – instead most visitors were able to view and enjoy the frieze in its appropriate position. The experiment also demonstrated that a key factor in this visibility was color, which allowed viewers to distinguish the horses and figures successfully. In fact, unless the viewer was very close to the krepis of the building, color played a larger role than relief in the frieze's legibility. This experiment, along with an informed study of ancient color, should reorient the way scholars think about the Parthenon frieze and the strategic role of color in its creation.

About the Nashville Parthenon

The Nashville Parthenon is the only full-scale replica of the Athenian building, located in the center of Nashville's Centennial Park, more than 5000 miles from the Athenian Acropolis (Fig 3.1). The first Parthenon replica in Nashville, built by architect Col. W.C. Smith and engineer Robert Creighton, was constructed in impermanent materials: plaster, wood, and brick. It was the centerpiece of the 1897 Centennial exhibition, and the only structure that was not demolished after the event (Fig 3.2). The would-be temporary temple was left standing in the park for nearly 25 years before it was deemed unsafe and disassembled.[147]

However, due to the immense popularity of the Nashville Parthenon to the inhabitants of "the Athens of the South," the Nashville Board of Park Commissioners elected to re-build the Parthenon in more permanent materials. This new Parthenon would be constructed in the modern material of concrete with colored aggregates to simulate the Pentelic marble of the Athenian building (Fig 3.3). Unlike the all-marble Parthenon in Athens, which rests on the foundation of an even earlier temple to Athena, the Nashville Parthenon stands on a foundation of rubble limestone. The inside of its walls are made of brick. Pentelic marble columns and roof beams are simulated by steal beams and trusses, covered in the pebbly concrete aggregate.[148] Architect Russell E. Hart, under the direction and guidance of architectural historian and Parthenon scholar William Bell Dinsmoor, designed the new Parthenon replica. Dinsmoor was particularly proud of the accuracy of the measurements in the interior of the Nashville cella, reputably accurate to three millimeters.[149]

The Nashville Parthenon was always intended to include all types of architectural sculpture as well as a full-scale replica of Phidias' masterpiece, the chryselephantine sculpture of Athena. However, the financial crash of 1929 halted work detail on the building and the completion of these projects. The akroteria, pedimental sculpture, and metopes had been cast in concrete and installed on the building, but work on the frieze and Athena had not yet begun. It was not until 1982 that the city of Nashville decided to resume their plans for building the colossal Athena. Nashville native sculptor Alan LeQuire's proposal won the commission.

---

[147] Creighton, 1989, 15.
[148] Tyler, 2004, 43.
[149] Beard, 2010, 7.

LeQuire relied heavily on the help of classical scholars to construct the 42-foot statue from 1982 to 1990. It was cast from gypsum cement and fiberglass and assembled over a steel armature, weighing over 15 tons. It stood as a monochrome statue for 12 years, and then was gilded and painted by LeQuire and gilder Lou Reed (Fig 3.4).[150]

Despite the large media response to the massive Athena and the building's constant use since it was reconstructed in concrete in 1925, it has not been possible to install the Ionic frieze sculptures as originally planned. During a restoration in 2001, the sculptures of the pediments and metopes were conserved and bird netting was installed in the pteromata, stretching from the cella to the outer colonnade (Fig 3.5). The space reserved for the Ionic frieze is now partially obscured by this bird netting. In the absence of blocks, the area originally intended for the Ionic frieze is filled with a plaster-like substance, which differs from the surrounding pebbly concrete in both tone and texture (Fig 3.6). The absence of the Ionic frieze from this space, paired with the completeness of the building and its proportional accuracy, made it the perfect place to conduct an experiment on legibility of the frieze.

The Emory Experiment at the Nashville Parthenon

The Nashville Parthenon provided an ideal opportunity to test the visibility of the Parthenon frieze. The Emory team visited the Nashville Parthenon in early September and took measurements and photographs in order to prepare for the experiment. The team also evaluated the space in the pteroma. After obtaining approval to install some kind of representation of the frieze on the empty course, the Emory team had to make a series of decisions resulting in the final production of the six canvas and one foam panel. Cost was a major limitation – the creation and installation of the panels had to be affordable. Time was another limiting factor; the Emory

[150] Nashville Parks Service, 2013, online.

Parthenon Frieze Project had to be completed during a full semester, giving the team roughly two months to work on the project. The duration of experiment was limited to one day, so the visual aids had to be created in a manner where they could be installed and safely removed in ten hours. It was also important that the structure of the Nashville Parthenon was not damaged as a result of the experiment. Finally, the visual aids had to be created in Atlanta and transported to the Nashville Parthenon in a standard vehicle, limiting the size shape and material. The team considered the possibility of printing to-scale photographs of the blocks, but decided that photographs of the blocks in their present state would not capture the original design or the crucial effects of color. The team also rejected the idea of installing casts of the existing frieze blocks because the course had been filled with plaster, requiring a relatively flat panel. The resulting full scale painted panels were the product of an involved process of research and deliberation (Fig 3.7). The canvas and foam panels were light, transportable, and made from inexpensive materials. However, they correctly depicted the shape and size of figures on the Parthenon frieze sculptures and could be painted using an informed study of ancient color.

Choosing the Frieze Blocks

The first step in creating the Ionic frieze panels was choosing how many reliefs to simulate. For several reasons, the Emory team chose to recreate reliefs from the northwest corner of the building. The northwest corner would be where viewers would begin their viewing of the Parthenon as they approached from the Propylaia and thus a good introduction to the Parthenon frieze. The composition of the northwest corner was also appealing as it portrays horsemen preparing to ride and beginning the procession. The Emory team elected to simulate panels of six frieze blocks that would wrap the northwest corner: one from the north side, and five from the west side, including NXLVII, WI, WII, WIII, WIV, and WV (see appendix). Of these six blocks, three of the originals are in the British Museum and three are housed in the New Acropolis Museum in Athens. By choosing these blocks, the panels would wrap the corner of the building and more than the space of one intercolumniation on the west side. Having a substantial stretch of panels would be important for gauging the effect of the outer colonnade of the visibility of the frieze in situ. Of the six blocks that the Emory team elected to recreate, there are eleven horses, seven mounted horsemen, eight horsemen standing by their mounts, one child, and one marshal. The figures and horses are dynamic and engaging, but not crowded, which facilitated the painting process. In these six panels, the overlapping of figures is limited to four horses and riders at its most crowded as opposed to seven overlapping horses in other parts of the composition (Fig 3.8).

The northwest corner of the frieze has also been reconstructed before. Victorian painter Lawrence Alma-Tadema depicted the northwest corner in his painting “Phidias Showing the Frieze of the Parthenon to His Friends.”[151] (Fig 3.9) The color choices that Alma-Tadema has made in regards to the Ionic frieze are unscientific. All of the figures on Alma-Tadema’s frieze wear white and their skin tone is the dark red of male figures in Minoan wall painting or Egyptian reliefs. However, Alma-Tadema does show the frieze with a blue background and the horses in different shades, both choices that the Emory team adopted in their recreation of the frieze panels.

This corner of the frieze has also been recreated in a digital model by the British Museum. Similar to Alma-Tadema’s choice to show the frieze at the figure’s eye level (made possible by the scaffolding which the Athenian elite walk on), the British Museum model also depicts the frieze blocks at an accessible angle, as if the viewer were floating in the upper space

---

[151] Barrow, 2001, 42-45.

of the pteroma, a viewing situation that would be impossible for an ancient visitor to the Parthenon (Fig 3.10). The British Museum has reconstructed the same reliefs with a different color scheme: bright primary colors used for the clothing and brown and black horses (Fig 3.11). Although the viewing angle they offer does not reflect an observable vantage, the two reconstructions by Alma-Tadema and the British Museum helped the Emory team visualize the colored frieze panels and decide which features of the previous reconstruction attempts were archaeologically valid before creating their own.

Once the specific blocks were chosen, the next step for the Emory team was deciding how to replicate the imagery. The scenes had to be created in a material that was inexpensive, transportable, durable, and relatively light. The reconstructions needed to be temporary as they could only be installed on the Nashville Parthenon for one day. The chosen solution was to create five flat canvas panels, which were mounted on wooden slats. The canvas panels could be rolled and transported easily. The team also decided to make one relief panel, which was created using rigid insulation foam. The relief panel would be half colored and half white to create the original conditions of the frieze block next to the current state of the blocks as they are displayed in monochrome marble. Having colored flat canvas panels, a colored three-dimensional relief panel, and a white three-dimensional relief panel would demonstrate the effects of both form and color in the visibility of the frieze, as the three types could be directly compared when they were all installed in situ on the building.

Creating the Colored Canvas Panels and Relief Panel

Both the canvases and relief panels were created in a series of steps that were replicated on all six of the panels to ensure uniformity. First the team examined photographs of each of the blocks (Fig 3.12). Then, the team examined the line drawings published by Jenifer Neils for the same blocks.[152] Neils's line drawings were isolated into each of the individual blocks using PhotoShop. (Fig 3.13) The line drawings were then projected onto a wall and scaled to the exact size of each of the original marble blocks (Fig 3.14). Canvasses were cut to the size of each block, allotting an extra canvas border around the edge for mounting. The canvases were then hung on the wall and the to-scale projection of the line drawing was traced onto canvases. A similar process of projection was followed for the figures and horses of relief panel, which were cut out of an insulation foam slab. These figures were mounted on a foam backpiece which-together with the figures and horses, mimicked the depth of carving present in the Parthenon frieze blocks.

The canvas panels were then primed and ready to be painted (Fig 3.15). Although the team considered the possibility of encaustic, it proved to be too expensive and dangerous for the limited resources of the project. Instead, modern acrylic paints were carefully mixed to match the hues of ancient colors derived from natural pigments. The first step was creating the right blue for the background, as it was the dominant color in all of the frieze panels and needed to be made in a large quantity. The blue that was mixed was color matched to the Egyptian blue pigment used on the background of the faux pediments and Ionic friezes of the Macedonian tombs at Lefkadia and Agios Athenassios (Fig 3.16). Because of the nature of acrylic paint, which dries a different color than the liquid paint, several attempts were required before the resulting blue on the canvas closely matched the color swatches from the tombs.

After mixing the blue, the next choice was deciding how to paint the second-largest area of color on the panels: the bodies of the horses. Depictions of horses on the Thracian tomb at Kazanlak, Macedonian furniture (Tomb of Eurydike) and wall painting (Tomb II at Vergina),

---

[152] Neils, 2001.

and the Roman Alexander mosaic inspired the choice to create five tones of horse: black, dark "umber" brown, sienna brown, gray, and off-white (Fig 3.17). All of these colors appeared in ancient depictions of horses (Figure 3.18). The team also elected to color the horses strategically when they overlapped so that the horses "furthest" from the viewer would be the darkest in tone, and most likely to recede into the background. The next choice was skin tone, which was similarly matched to skin color on the paintings of the Macedonian Judgment Tomb and the tombs at Aghios Athanassios and Thracian tomb at Kazanlak. Because all the figures on the six recreated blocks were male, the same skin color was applied to all of them. However, if there had been women depicted in the frieze panels, they would have been painted with a lighter skin tone. The choice of clothing colors came from the test results of extant paint on the Parthenon, previous reconstructions, and the clothing depicted in Macedonian tombs and on vase painting. Before it was applied to the canvas, each color was pre-mixed and tested to ensure that when it dried on the canvas, it would match the tone of ancient paint created with natural pigments. (Fig 3.19)

Once all the paint had been applied to the large areas of the canvas, detail work began. The facial features of each of the horsemen were drawn onto the canvas and then painted. The eyes, manes, and veins of the horses were translated from photographs of the blocks to the canvas panels. Minimal contour, shading, and modeling were added. These touches were done in a limited degree as evidence concerning shading and modeling in the classical period is limited and the team did not wish to add work without good evidence. Some elements of the original blocks' composition featured details that were only painted, not carved such as sandals or patterns on the clothing. The blocks also originally employed bronze attachments for the gear of the horses that have been lost. All of these details were re-created in paint by the Emory team, drawing on contemporary statues, texts, and vase painting to make educated guesses about the missing elements (Fig 3.20). When the original rendering of detail was unclear (such as the reins of the horse in the WIII block) – the Emory team chose not to include that detail. The canvases were then mounted and the extra edges folded flat so that each canvas would match the dimensions of the block it represented.

After the relief panel in insulation foam was assembled, fabric details were added using cheesecloth and white glue. The relief panel was then sealed with joint compound and white glue. Then, a similar painting process was applied to the three-dimensional relief panel (Fig 3.21). The same acrylic paints, which had been pre-mixed to match ancient colors, were used on the foam panel.

Installing the Panels

The six panels were transported to the Nashville Parthenon on November 9th, 2012 for their installation the next day. Team members used a lift to access the frieze course, located approximately 40 feet above the stylobate of the building. A specialty lift was brought within the colonnade in order to install the panels in place (Fig 3.22). However, this first lift proved unsuccessful because, while it rose to the right height, it had no extension allowing the team member to reach the frieze. A second lift was ordered, and after positioning it, team members were raised up to the level of the frieze band where they installed the panels in place using industrial-strength Velcro. However, because the basket of the second lift could not be raised to the full height of the frieze course, paint rollers and extension rods were used to install the panels. The canvas panels were installed first, then the sculpted relief panel was installed in place (Fig 3.23).

Several unforeseen factors limited the installation of the panels. First, the team could not remove the bird netting that stretched across the pteroma from the top of the colonnade to the cella from the corner and north side. Thus the end of the northern side was not accessible and the panels that represented NXLVII and WI could not be installed. Instead they were hung at eye level on the cella wall to provide a contrast to the frieze panels installed in situ. Second, lightboxes that were affixed to the colonnade blocked the lift at certain key places. Thus, the panels on the western side could be installed, but there was an approximately six-inch gap between two of the panels where the light box obstructed installation (Figure 3.24). Despite these challenges, eventually five panels were installed, including colored 4 canvas panels and the relief panel (Fig 3.25).

After the panels were installed, park visitors were invited to participate in a survey aimed at determining the visibility of the frieze. Ninety-five visitors were formally surveyed and many more provided input. Team members facilitated the completion of the survey at various viewing points based on the route of the ancient Panathenaic Procession (Fig 3.26). Team members recreated the processional route on the Athenian Acropolis, staking out the paths and the impediments with contractors' spray. Survey participants moved along the passages and described how well, and how much of the frieze they could see.

Survey Results

The survey was administered to 95 park visitors to the Nashville Parthenon Project. Survey participants consisted of visitors to Centennial Park, employees of the Nashville Parthenon, and students and faculty from Vanderbilt University and Emory University. The survey asked six types of questions, each of which examined a different aspect of the visitors' experience. Those question types were:

1. Introductory questions to measure the visitor's familiarity with the history of the Athenian Parthenon and/or Nashville Parthenon.

2. Questions that evaluated the order in which visitors viewed the three types of sculpture on the Nashville Parthenon.

3. Questions that examined movement of the visitor in relation to the figures on the Parthenon Frieze.

4. Questions on the role of relief in viewing the Ionic frieze.

5. Questions meant to evaluate the role of color in viewing the Ionic frieze.

6. A conclusion question about the exercise and lasting impressions.

A sample of the survey can be found in the appendix.

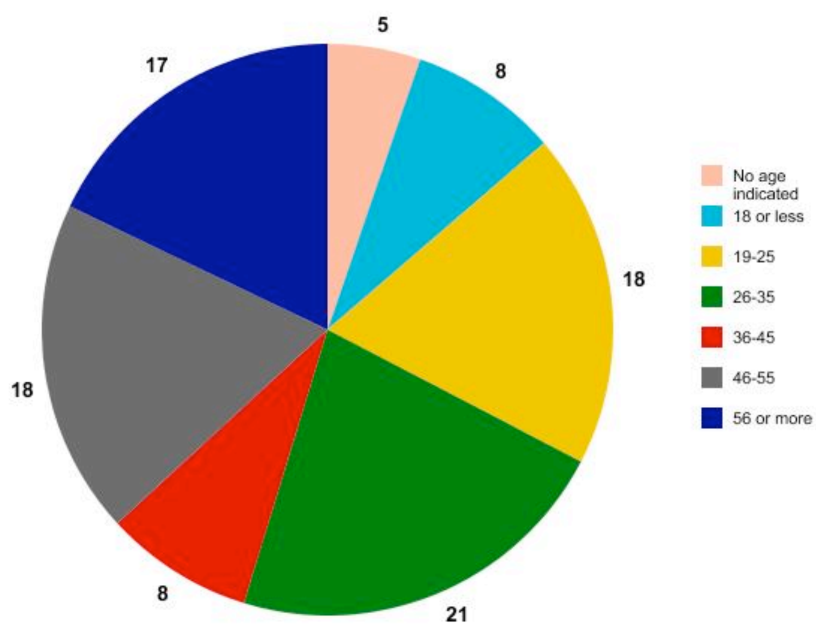
A. Demographics of Participants

1. Gender Demographics

The 95 visitors who completed the survey were diverse in their background and age. Of the participants, 52 were women, 38 were men, 1 was trans-gender, and 4 did not indicate their gender.

2. Age Demographics

The median age group was 26-35 years old and 50 percent of the project participants were 26 to 55 years old.



B. Background Knowledge and Familiarity with the Parthenon(s)

Of the 95 visitors who completed the survey, 25 had visited the Athenian Parthenon and 20 had seen the Parthenon sculptures in the British Museum (the Elgin Marbles).

	Athenian Parthenon	British Museum Parthenon Sculptures
Number of survey participants who had visited	25	20
Percentage of survey Participants who had visited	**26.3%**	**21%**

Participants were asked to indicate whether they had studied the Athenian Parthenon or had previously visited the Nashville Parthenon.

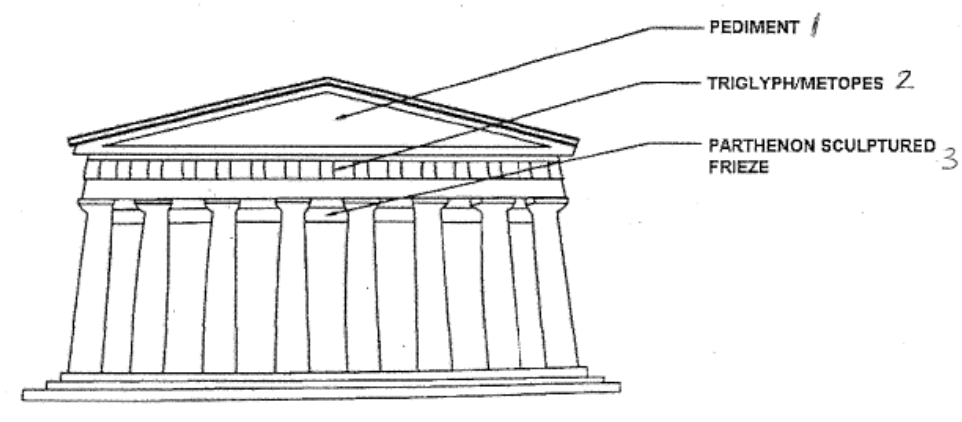
	Had never studied the Parthenon	Had studied the Parthenon "a little"	Had studied the Parthenon extensively
Number of survey participants	43	30	20
Percentage of survey participants	**46.2%**	**32.3%**	**21.5%**

Participants were asked to indicate their previous knowledge of the Parthenon .

	Had never visited the Nashville Parthenon	Had visited the Nashville Parthenon a few times	Had visited the Nashville Parthenon frequently
Number of survey participants	42	35	16
Percentage of survey participants	**45.2%**	**37.6%**	**17.2%**

C. Sequential Viewing Order

Survey Participants were asked to indicate the order in which they observed the three zones of sculpture on the Parthenon. They were provided with the image below. About 80% of the participants first noticed the pedimental sculpture, then that of the triglyphs and metopes, and finally the temporary frieze panels.



	Pediment, triglyph, freize	**Triglyph, pediment, frieze**	Did not indicate order
Number of Survey Participants	68	16	11
Percentage of Survey Participants	**80.9%**	**19%**	-

D. Movement and the Parthenon Frieze

The second set of survey questions addressed the idea of movement, particularly the relationship between the movement of the figures on the frieze and the viewer – who physically moves to view the carved procession. Robin Osborne had explored ideas of focus, movement, and dynamics in his essay "Viewing and Obscuring the Parthenon Frieze" and the Emory team hoped to test some of his ideas. The survey asked four questions addressing the issue of movement. However none of the results were could be interpreted properly because the team could not install the panels on the north side.

The first question in this section asked if viewing the horses and riders made the viewer want to move in a particular direction. The survey participants were asked to indicate their response on a scale from 1 to 5, with 1 indicating that they felt no desire to move, 3 indicating that the composition motivated them to move "a little" and 5 indicating that they did feel motivated to move. The average response was 3.4 out of 5.

Survey Question	Average Participant Score (on a scale from 1 to 5)
Do they make you want to move in a particular direction?	3.40
Do the figures in the frieze make you want to move around the corner?	3.69

The second question asked if the columns blocked the view of the frieze, with a score of 1 signifying that the columns did not block the view whatsoever and a score of 5 indicating that the columns blocked the view "a lot." The average response was a 3.38 out of 5. The third question asked if the columns helped the viewer focus on parts of the frieze, an idea that Osborne had set out in his essay. On the same scale as the previous question, the average response was a 3.31 out of 5.

How much do the columns block your view of the frieze?	3.38
Do the columns help you focus on parts of the frieze?	3.31

The final question about movement asked if the figures in the frieze made you want to move around the northwest corner of the building. This question was largely disregarded in the later processing of the survey results. Because we only had panels installed on the west side of the building. Participants would not have seen additional panels if they turned the corner to the northern side of the Nashville Parthenon. On the same scale as the previous questions, the average response was a 3.69 out of 5, indicating that participants were only somewhat motivated to turn the corner. The average results of 3.4, 3.38, 3.31, and 3.69 were did not demonstrate that the viewers had a strong inclination to move in relation to the panels, and the results of this section of the survey were generally inconclusive in regards to the viewer's movement in relation to the installed panels or the columns.

E. The Role of Relief on the Parthenon Frieze

Like the evaluation of movement on the Parthenon Frieze, limitations prevented the team from completing a full evaluation of the role of relief in the legibility of the ionic frieze sculpture because the relief panel – which included both a painted color section and a plain white "marble" section – did not remain installed within the frieze course as long as the flat canvas panels. The relief panel fell off the building after about two hours and could not be re-installed. For that reason, only about one-third of survey participants completed the survey during the time that all three types of sculpture were in place (colored and flat, colored and in relief, monochrome relief). The smaller sample size of survey participants makes the findings in regard to relief less strong than those concerning the power of color alone. Nevertheless, the thirty survey participants who completed the exercise did provide some insight into the role of relief in legibility of the frieze. The first question concerning relief asked if the figures were clearer on the colored relief (left) or the unpainted relief (right).

	Colored Relief Panel	Unpainted Relief Panel
Number of Participants who found the panel more "clear"	22	8
Percentage of Participants	**73%**	**26.7%**

The second question asked if the relief on the unpainted white panel made a difference to figures on a scale from 1 to 5, where a score of 1 meant that relief did not matter at all and a score of 5 meant that relief affected the visibility "a lot." The average score was 4.09 out of 5, indicating that the survey participants did agree that relief mattered in the legibility of the figures.

F. The Power of Color on the Parthenon Frieze

Unlike the examination of movement, which was negatively effected by our inability to install panels on the north side, or the examination of relief, which did not have the ideal number of participants, the survey was more robust in gauging the importance of color to the viewing process of the Parthenon frieze. Survey participants indicated that they were able to distinguish colors and forms from the background. Many participants also wrote in comments in the "final thoughts" section regarding the power of color. The first two survey questions regarding color asked participants to rank their ability to distinguish compositional elements from the background color, blue.

Survey Question	Average Participant Score (on a scale from 1 to 5)
How clearly can you distinguish the horses against the background?	4.00
How clearly can you distinguish people against the background?	4.63

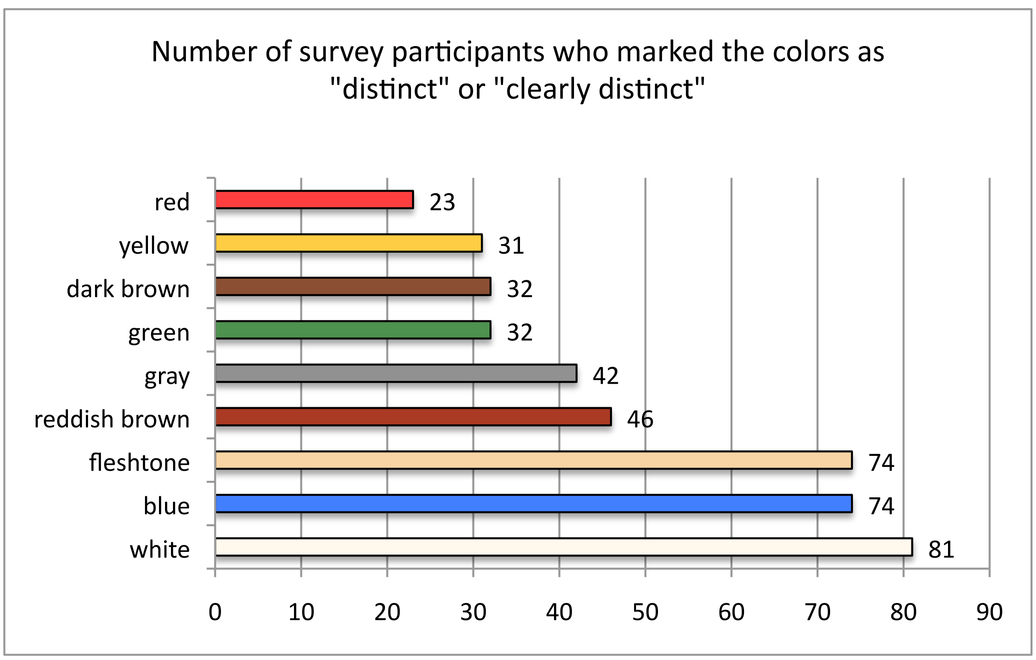
Participants indicated that they were able to distinguish horses from the blue background to some degree with an average score of 4.0 out of 5, on a scale where 1 indicated that the horses were indistinguishable from the background and 5 indicated that they were "clearly distinct."

Similarly, participants indicated that they were able to distinguish people from the blue background to some degree with an average score of 4.63 out of 5, on a scale where 1 indicated that the figures were indistinguishable from the background and 5 indicated that they were "clearly distinct." Participants were then asked to indicate which colors were most visible on the following chart:

13) Please indicate on the chart below how well you can see each color in the panels.

Color	1- Not at all	2	3	4	5-Clearly distinct
Blue					
Red					
Yellow					
Green					
Gray					
Black					
Flesh tone					
Reddish Brown					
Dark Brown					
White					

Scores of 4 or 5 indicated that those colors were distinct or clearly distinct to the survey participants. The colors, which received scores of 4 of 5 most often across the pool of survey participants, were respectively, white, blue, and flesh tone.



100% of participants gave at least two colors the scores of 4 or 5, indicating that everyone who participated could distinguish or clearly see at least two of the colors.

Participants then filled out a similar chart gauging their ability to distinguish detail features of the composition including facial features, men's footwear, horses' bridles and reins, and the veins on the horses. These were scored on the same scale of 1 to 5, with a score of 1 indicating that the details were not visible at all, and a score of 5 indicating that the features were "clearly distinct. 96% of participants could see some of the detail features. Only 2% of participants said that they could not make out any of the detail features.

Many survey participants also indicated the importance of color in their "final thoughts" comments (included in appendix).

Conclusion

In order to understand the Parthenon, we must cast off the modernist western preference for pristine white marble sculpture and architecture. Instead, it is important to recognize that monuments of antiquity were not only colored, but that this polychromy was an intrinsic part of the viewing experience. Color was used by architects and artists to control the experience of the visitor to the Parthenon. Archaeological and textual evidence provide verification for the existence of color and modern scanning, photography, and chemical analysis now allow modern scholars to interpret this evidence further.

It is not possible to simulate the experience of an ancient worshipper visiting the Parthenon. However, responses from the experiment undertaken by the Emory team at the Nashville Parthenon have demonstrated that the facsimile building wields an immense visual power that resonates with viewers, even when it is displaced nearly 2500 years and 5000 miles from the original viewing conditions. The building's ability to captivate derives from the structural elements of the architecture, the giant representation of Athena, and the architectural sculpture. Today, the original sculptures exist in many states of preservation and many locations around the world, but they were once part of the unified whole. To form a complete picture of their visual role, these sculptures must be returned to their proper positioning on the building, but also to their original state: one that was colored. In doing so, it becomes apparent that the Ionic frieze blocks were not hidden away, but rather, strategically placed for the visitor's preparation to enter the temple. Their composition, placement, iconography, and color would have functioned concordantly, and the congruous combination of these elements in is only fitting for one of the most remarkable buildings of antiquity.

Chapter One Figures

Figure 1.1
The Parthenon on the Athenian Acropolis, as seen from South East
(Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.2 Ancient quarrying process at Pentelikon, Drawing by Manolis Korres,

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.3 Plan of the so-called Preparthenon, destroyed by the Persians, Drawing by Manolis Korres

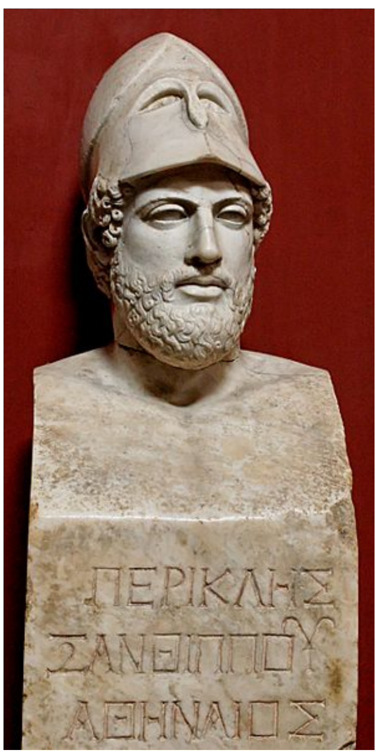


Figure 1.4 Bust of Pericles, Roman Copy after a Greek original ca. 430 BC, Vatican Museums, (Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.5 Plan of Parthenon, demonstrating octostyle Doric peripteral plan by architects Iktinos and Kallikrates, Drawing by Manolis Korres.

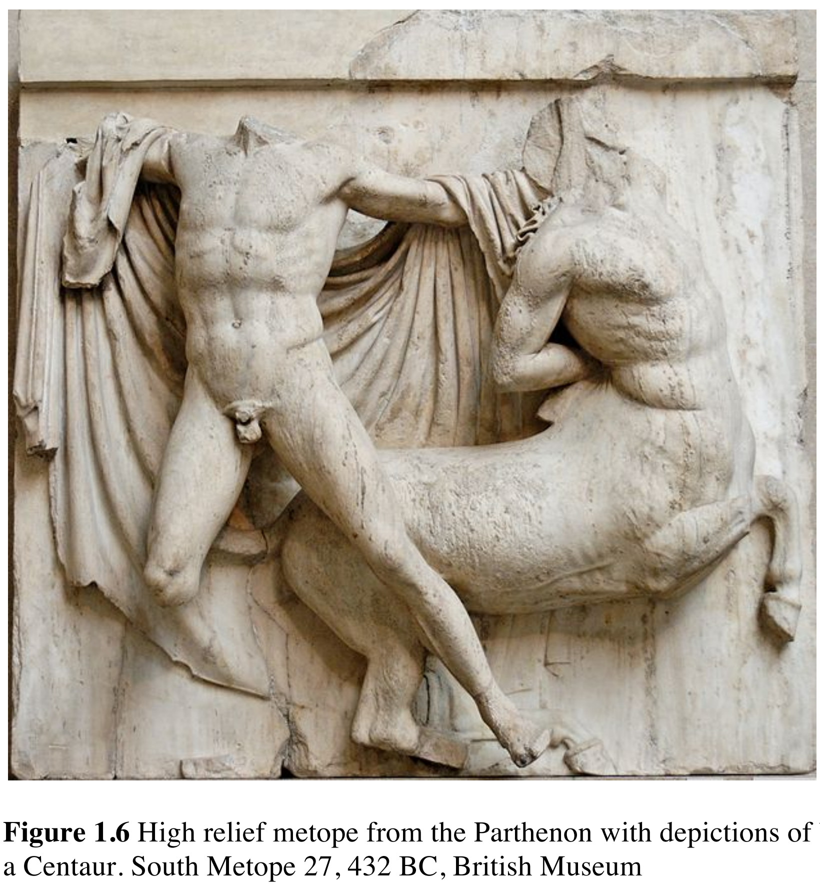


Figure 1.6 High relief metope from the Parthenon with depictions of battle between a Lapith and a Centaur. South Metope 27, 432 BC, British Museum
(Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.7 Drawing of the West Frieze Blocks by John Boardman
(Image: The Beazley Archive)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.8 Cutaway drawing of the pteroma, displaying location of Ionic frieze in relation to cella and colonnade. Drawing by Manolis Korres

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.9 Diagram of Parthenon Frieze Iconography by Jenifer Neils (Image: Neils)

Figure 1.10 East Frieze blocks depicting the Peplos ceremony, ca 432 BC, British Museum. (Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.11 Cutaway drawing demonstrating location of the Ionic frieze in relation to the sculpture of the pediment and metopes. (Image: Neils)

Figure 1.12 North side of Parthenon in March, 2013. The Acropolis Restoration Service is slowly rebuilding the damaged cella using replacement blocks. (Image: Levitan)

Figure 1.13 The Parthenon frieze blocks as they are currently displayed in the Duveen Gallery British Museum, London (Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.14 View of the New Acropolis Museum, completed 2009. The top floor gallery that houses the frieze blocks is rotated to be on axis with the nearby Parthenon. (Image: Bernard Tschumi)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.15 Parthenon Frieze blocks from the Southwest corner of the building as they are displayed in the New Acropolis Museum, Athens, Greece (Image: New Acropolis Museum)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.16 Oblique view of frieze blocks, displaying low relief carving **(Image**: British Museum)

Figure 1.17 Blocks S-X and S- XI from the South side of the frieze which do not “respect” the join. Notice the figure and horse which are bisected by the join between the blocks. (Image: Creative Commons)

Figure 1.18 Block WII from the West side of the frieze. The blocks on the west side of the frieze “respect the joins” and figures and horses fit cleanly within the uniform length of the block. (Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.19 Sculptors carving the Parthenon Frieze in situ (left) and the so-called “guide strip” for carving. Drawing by Manolis Korres.

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.20 Block WV demonstrates the isocephaly of the horses, mounted riders, and standing horsemen. (Image: New Acropolis Museum)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 1.21 Block EV from the East Side of the Frieze demonstrates the isocephaly of the seated Olympian gods and the standing human participants of the peplos ceremony. (Image: British Museum)

Figure 1.22 The northwest corner block of the Parthenon frieze. A marshal begins the composition on the Western side of the frieze. (Image: Creative Commons)

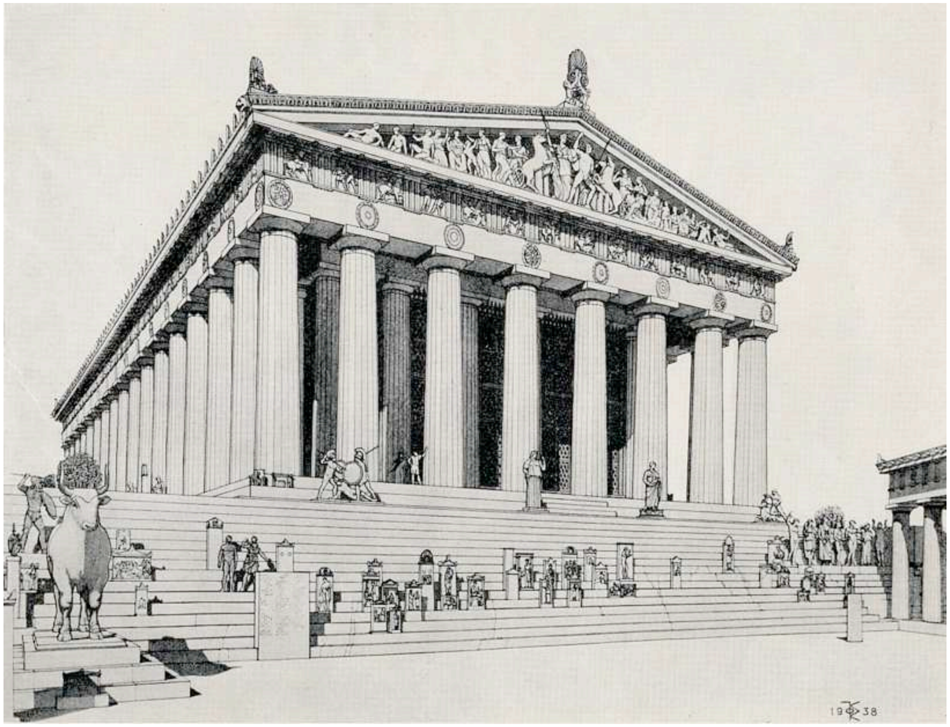


Figure 1.23 A double stairway led to the Parthenon. Gorham Stevens identified the intermediate platform as the most likely place to view the Ionic frieze. Drawing by Gorham Stevens.

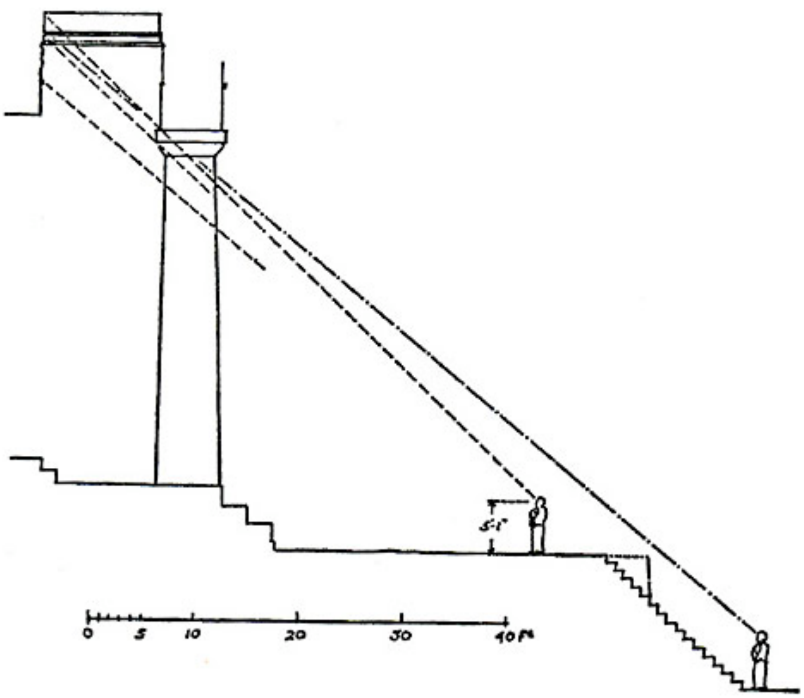


Figure 1.24 Stillwell used a model approximate the ideal viewing conditions of the Parthenon Frieze. Drawing by Richard Stillwell

Figure 1.25 Plaster casts of the Parthenon frieze as seen through the colonnade. (Image: Creative Commons)

Chapter Two Figures

Figure 2.1 Detail from Roman brightly colored wall fresco in the Villa of the Mysteries, Pompeii 70-60 BC, Pompeii, Italy (Image: Creative Commons)

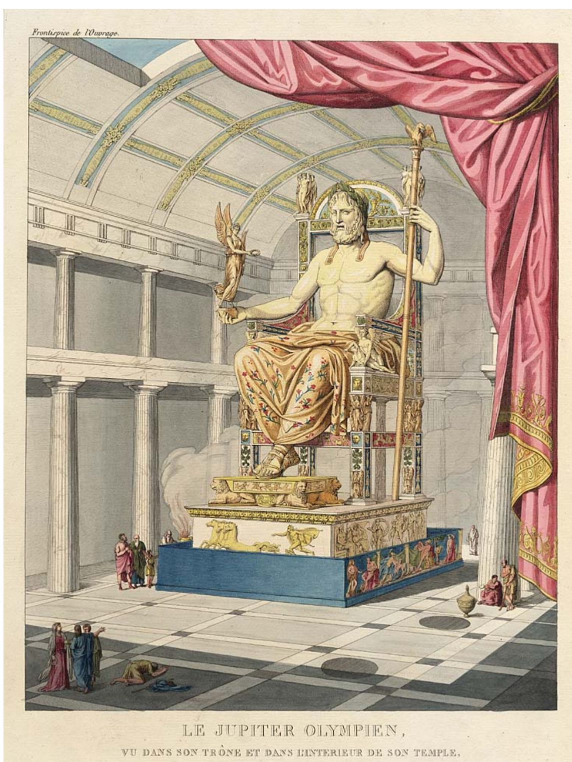


Figure 2.2 Antoine-Chrysostome Quatremère de Quincy**,** Le Jupiter Olympien color reconstruction, 1814 (Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.3 Reconstruction of the façade of the temple of Aphaia at Aegina
Charles Garnier, 1852, (Image: Van Zantan)

Figure 2.4 Jacques-Ignace Hittorf's Reconstruction of Temple B at Selinus includes extensive polychromy, 1851 (Image: Creative Commons)

Figure 2.5 All white Renaissance statues like Michelangelo's David created a western aesthetic which favored pristine white marbles. David, 1501 – 1504, the Accademia di Belli Arti, Florence, Italy (Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.6 Charles Newton made drawings to record the preserved paint on building elements from the Mausoleum of Halicarnassus (Image: Van Zantan).

However "monochromists" dismissed his color reconstructions, causing him to remove a sample of pigment (left) and send it back to England as proof (Image: Jenkins)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.7 19TH Century Reconstructions of the Parthenon's Entablature:
A. Paccard, 1845 (Image Van Zantan) B. Kugler, 1835 (Image: Van Zantan)
C. Seeman, 1877 (Image: Creative Commons) D. Loviot, 1879 (Image:Van Zantan)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.8 19th Century Reconstructions of the Parthenon
A. Gottfried Semper, reconstruction of the Parthenon and acropolis. 1834 (Image: Van Zantan)
B. Alexis Paccard , reconstruction of the east façade of the Parthenon, 1845-1846 (Image: Van Zantan)
C. Ludvig Fenger, Reconstructions of the Parthenon Frieze from *Dorische Polychromie,* 1886 (Image: Van Zantan)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.9 Preserved Paint on the Parthenon Sculptures in the British Museum

A. The “brushstroke” found on the back of Pedimental Figure F (Image: Jenkins)

B. Infared scanning reveals the presence of Egyptian blue pigment, seen as the white spots on the image on the right. (Image: British Museum)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.10 Preserved Paint on Parthenon sculptures in the New Acropolis Museum, Athens.

A. Photographs of the extant color found on the Kekrops pedimental sculpture. (Image: Vlassopoulou)
B. Horseman 17 from the West side of the frieze preserves pigment. (Image: Vlassopoulou)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.11 Torso of a Cuirassed Archer, 460 BC, currently in the New Acropolis Museum (all images: Brinkmann)

A. As the sculpture appears normally
B. Incisions visible under UV light
C. A reconstruction by Brinkmann
D. An alternate reconstruction by Brinkmann with gilding.

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.12 Classical Head, ca. 425 BC, now in Copenhagen (all images: Copenhagen Polychromy Network)

A. In normal light
B. In UV light
C. A detail of the preserved paint in UV light
D. Paint samples that were tested

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.13 Color reconstruction by Vinzenz Brinkmann and Ulrike Koch-Brinkmann of the East Frieze of the Siphnian Treasury, original: Greek, c. 525 BC, Archaeological Museum, Delphi. (Image: Brinkmann)

Figure 2.14 Architectural fragments from the temple of Aphaia at Aegina preserve a large amount of ancient encaustic color. (Image: Levitan)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.15 The archaic korai in the New Acropolis Museum in Athens preserve a large degree of color and many detail features. Some of these details in the textiles, hair, and eyes of the sculptures are pictured above. (Images: New Acropolis Museum)

B.

Figure 2.16 Peplos Kore, 530 BC, New Acropolis Museum, Athens

A. The Peplos Kore in the New Acropolis Museum preserves a substantial amount of pigment and has been the subject of several color reconstructions. (Image: New Acropolis Museum)
B. A reconstruction of the same sculpture in the Museum of Classical Archaeology in Cambridge was painted by curator Robert Cook in 1975. It was restored and partially repainted in 1996. (Image: Creative Commons)
C. Two reconstructions made by Vincenz Brinkmann for the exhibition "The Color of Life." (Image: Brinkmann)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.17
Athenian White Ground Lekythos with a depiction of a warrior taking leave of his wife
Attributed to the Achilles Painter, 440 BC, National Archaeological Museum, Athens (Image: Oakley)

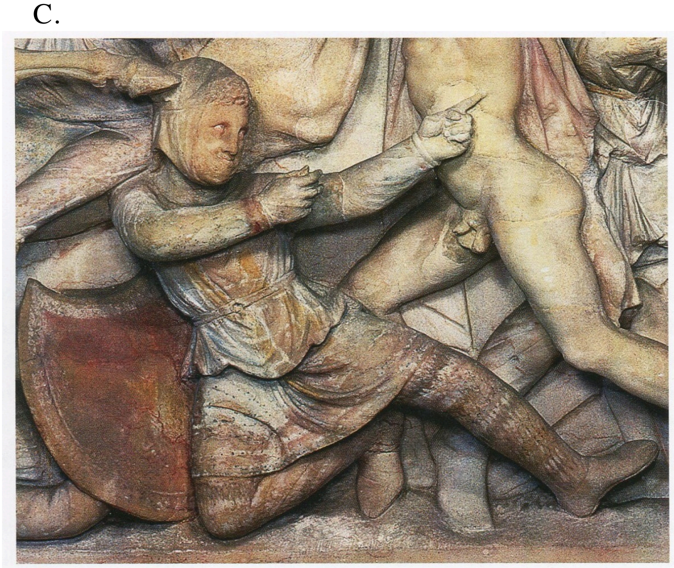
The treatment of the eye shield device displays a complex understanding of shading and form.

Figure 2.18 Fragments from Kalyx Krater depicting a Gigantomachy.Achilles Painter, 450 BC, Michael C. Carlos Museum, Atlanta Georgia (Image: MCCM)

A.

B.

C.



D.

Figure 2.19 (Images: Creative Commons)

A. The Alexander Sarcophagus, Late 4th Century BC, National Archaeological Museum, Istanbul

B. A detail view of a Persian archer

C. The tights of the archer, with a rhomboid pattern

D. The clothing, facial features, and hair of the archer are distinguished with complex shading and color.

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.20 The Mausoleum at Halicarnassus used five different types of stone. (Image: Jenkins)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.21 Kerch style Vase, Attributed to the Painter of the Wedding Procession 360 BC, now in the Getty Museum (Image: Getty)

A.

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

B.

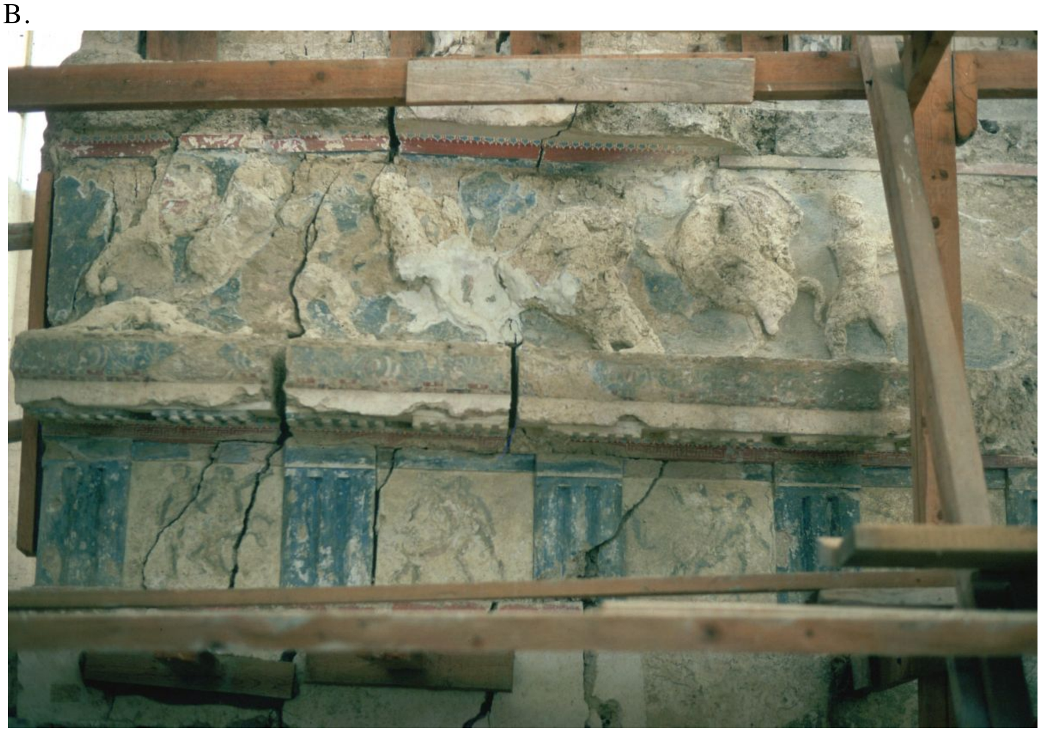


Figure 2.22 Tomb of the Judgment at Vergina, last quarter of the 4th century BC.

A. A watercolor reconstruction (Image: Petsas)

B. A detail displays the frieze course of the monument. (Image: Creative Commons)

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

Figure 2.23 The Tomb of the Palmettes at Lefkadia, 3rd Century BC (Images: Rhomiopoulou)

A. Exterior of tomb
B. Detail of pediment
C. Detail from interior

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

Figure 2.24 The Tomb at Aghios Athanassios, 315 BC (Images: Rhomiopoulou)

A. Exterior of tomb
B. Architectonic detail
C. Detail of procession

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.25 Life sized soldiers on the tomb at Aghios Athanassios, 315 BC (Image: Rhomiopoulou)

Figure 2.26 Minoan Fresco from Akrotiri, Crete, ca 1600 BC (Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.27
A. Apulian Red Figure Column-Krater with a depiction of an artist painting a marble statue of Herakles. 350-320 BC, Metropolitan Museum of Art (Image: MMA)
B. detail

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.28

A. An ancient "paint kit" assembled by modern conservators. All the minerals above were used by ancient painters on Delos (Image: Brinkmann)

B. A cake of blue pigment found in a tomb at Cmairus, Rhodes, now in the British Museum (Image: Jenkins)

A.

B. C.

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.29

A. Differential weathering preserves a “ghost image” from this tile cover from the temple of Aphaia at Aegina. (Image: Levitan)
B. The crown moulding over the ionic frieze preserves a “ghost image” of the encaustic paint. (Image: Jenkins)
C. Paint from this moulding has been reconstructed by F. Penrose. (Image: Jenkins)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 2.30

One of the reconstructions that Vincenz Brinkmann completed for the exhibition “Gods in Color.” The painted plaster cast of Athena from the Temple of Aphaia at Aegina stands in front of the original in the Munich Glyptothek. (Image: Brinkmann)

Original sculpture from the Western Pediment of the Temple of Aphaia at Aegina, 500-505 BC

Chapter Three Figures

Figure 3.1 The Nashville Parthenon in September, 2012. (Image: Robin Prater)

Figure 3.2 The Centennial celebration in 1897 included many temporary structures, but the Nashville Parthenon was the most popular. (Image: Nashville Parks Service)

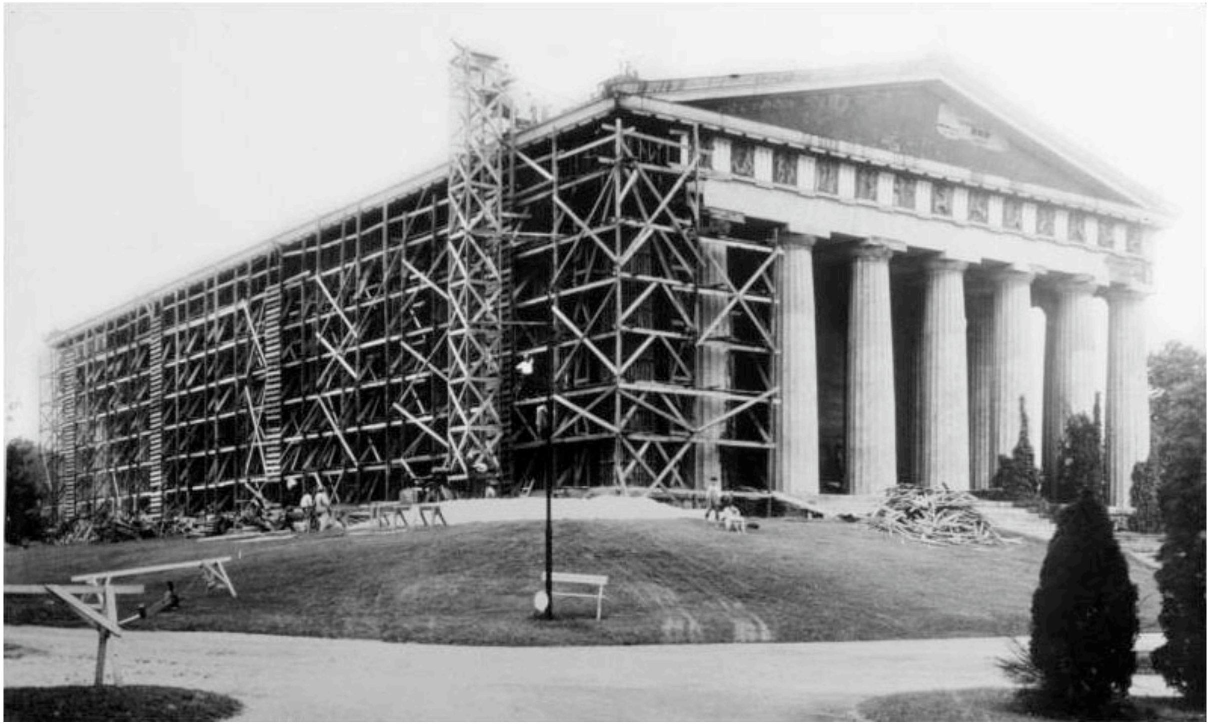


Figure 3.3 Reconstructing Nashville Parthenon in permanent materials (Image: Nashville Parks Service)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 3.4 Nashville native and sculptor Alan LeQuire with the Athena. (Image: LeQuire)

Figure 3.5 Bird netting stretches from the colonnade to the cella. Here, Emory professor Richard Patterson can be seen detaching the bird netting on the day of the experiment. Also visible is the pebbly surface of the concrete. (Image: Jiang)

Figure 3.6 The frieze course of the Nashville Parthenon is filled with a plaster-like substance. (Image: Jiang)

Figure 3.7 The colored canvas panels created by the Emory Team, before the experiment. (Image: Cupello)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 3.8 At some parts of the composition, as many as seven riders overlap on one block. (Image: Jenkins)

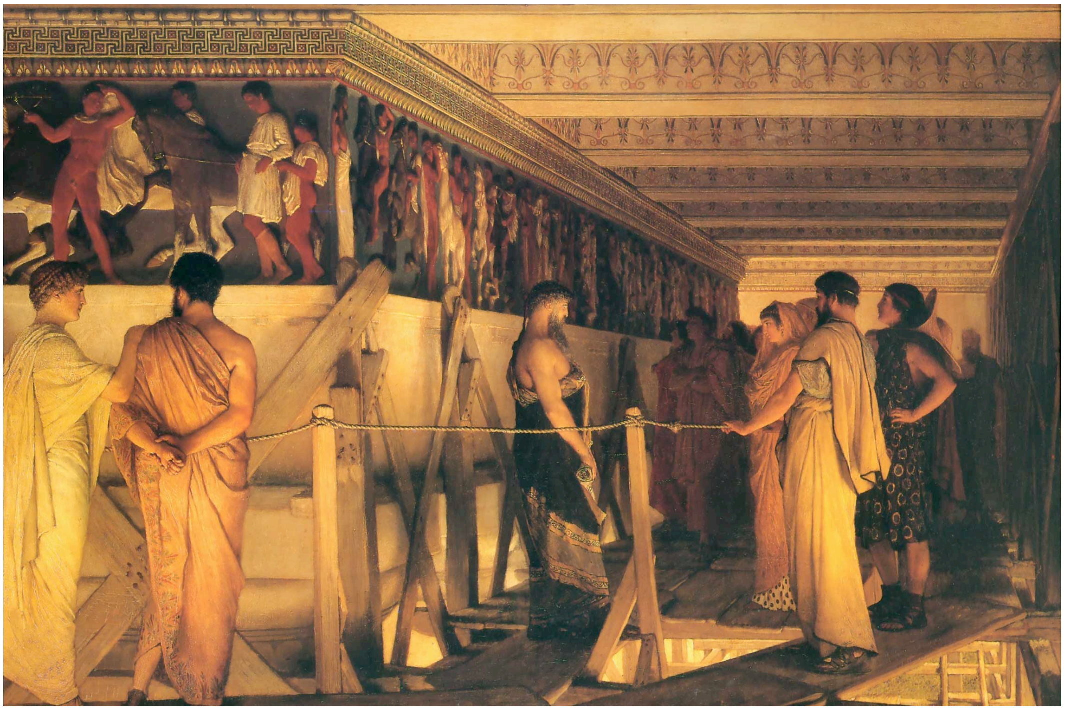


Figure 3.9 Phidias Showing the Frieze of the Parthenon to His Friends, Lawrence Alma-Tadema, 1868, Birmingham Museum and Art Gallery (Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 3.10 The British Museum's reconstruction of the northwest corner of the Ionic frieze. The lighting conditions in this image are impossible considering the shadow cast by the roof. (Image: Jenkins)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 3.11 The British Museum's reconstruction uses a palette of primary colors and neutrals. (Image: British Museum)

Figure 3.12 Photograph of Block NXLVII that was studied by the Emory Team before creating the canvas panel. (Image: Creative Commons)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 3.13 Line drawing of block NXLVII (Image: Neils).

Figure 3.14 The line drawings were projected to the correct size, and then traced onto the canvases. Here we see the same drawing of NXLVII. (Image: Levitan)

Figure 3.15 The canvases were primed before the acrylic paint was applied. (Image: Wescoat)

Figure 3.16 Matching blue paint to color samples of ancient pigments. (Image: Levitan)

IMAGE
UNAVAILABLE
FOR COPYRIGHT
REASONS

Figure 3.17 The color of horses on ancient monuments were replicated for the Parthenon frieze panels, such as this horse from the Tomb of Eurydike at Vergina (Image: Brekoulaki)

Figure 3.18 The base color for the horses is applied to the canvas panels. (Image: Wescoat)

Figure 3.19 Colors were applied by team members one by one, until all the major areas of color were filled. (Images: Levitan)

A.

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

B.

Figure 3.20 The Emory team turned to other classical examples for details that were not preserved on the Parthenon Frieze blocks.

A. Sandal on fragment from Delos (Image: Brekoulaki)
B. The style was reproduced on the Emory panel (Image: Levitan)

Figure 3.21 The foam relief panel on the day of the experiment (Image: Tsakirgis)

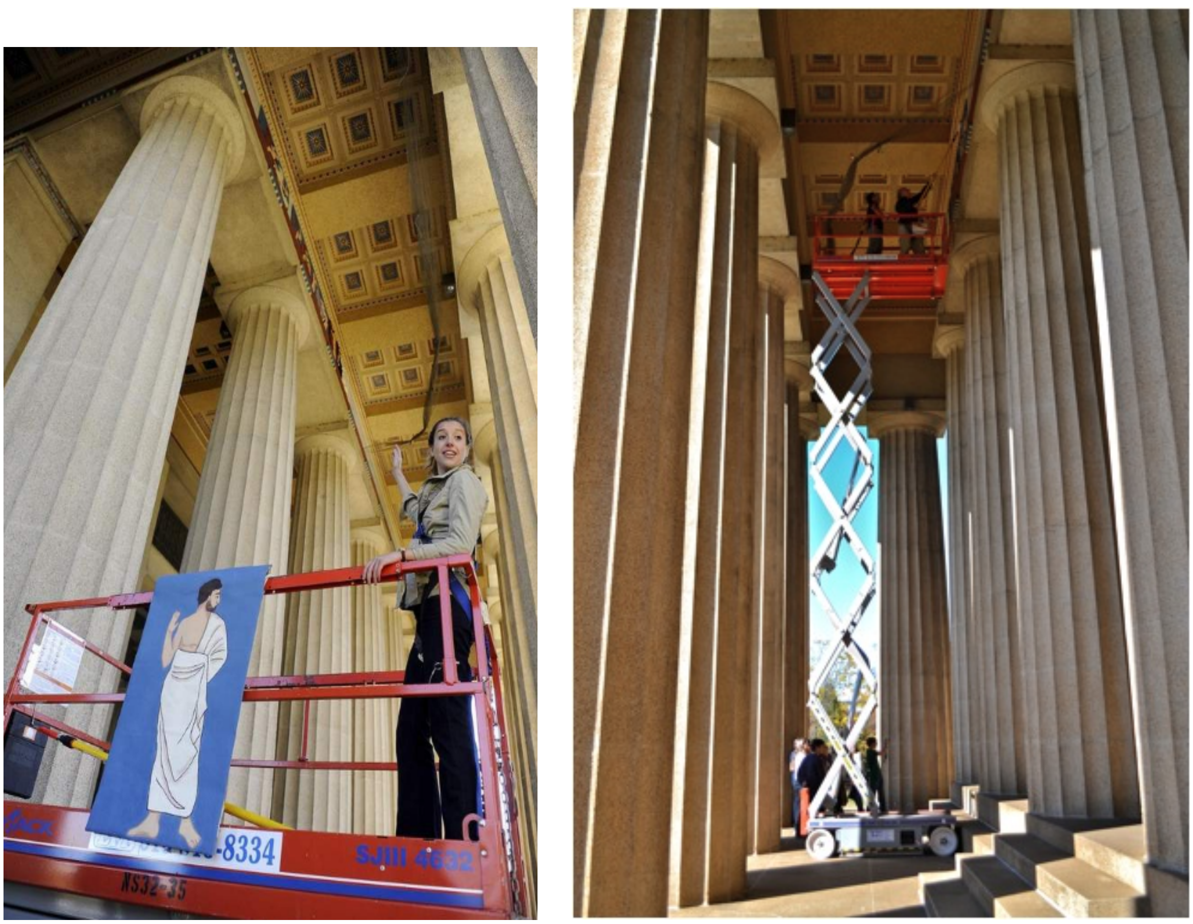


Figure 3.22 A specialty lift was used to reach the frieze course (Image: Nashville Tennesean (left) and Jiang (right))

Figure 3.23 The frieze panels were positioned and installed using velcro and a paint roller. The same method was used for the relief panel. (All Images: Cupello)

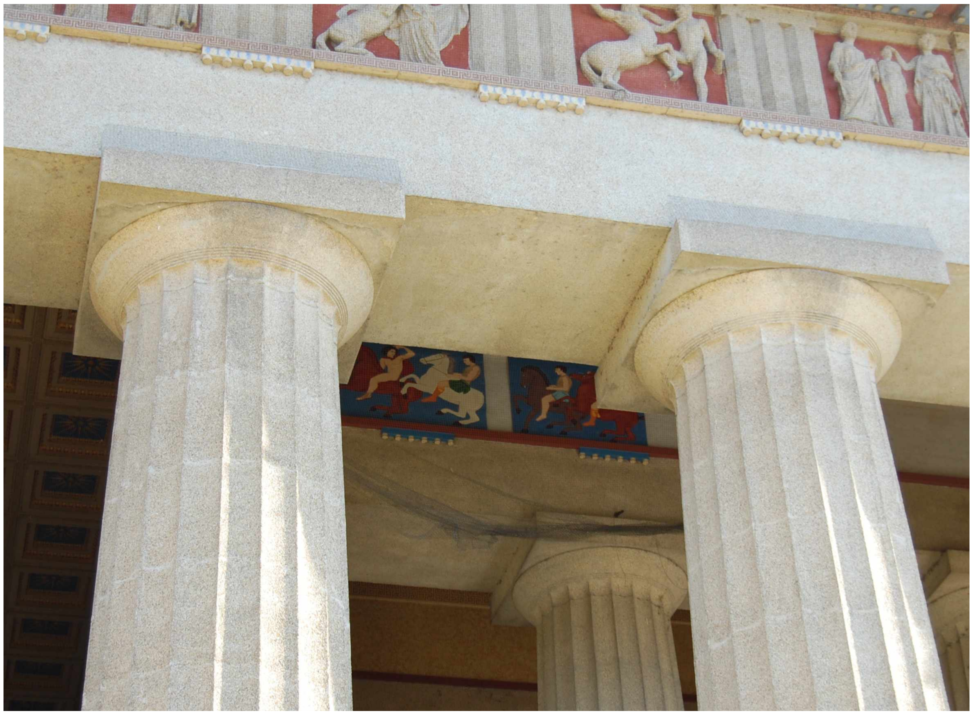
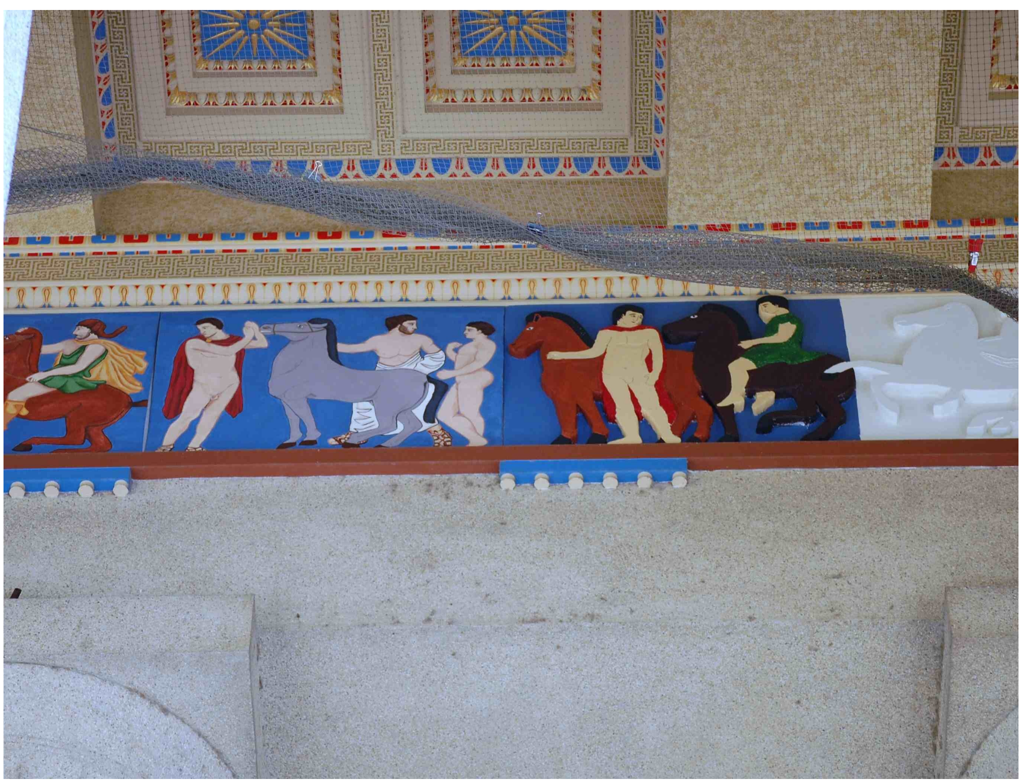


Figure 3.24 The lightboxes prevented the contiguous installation of WII and WIII. (Image: Cupello)

A.



B.

C.

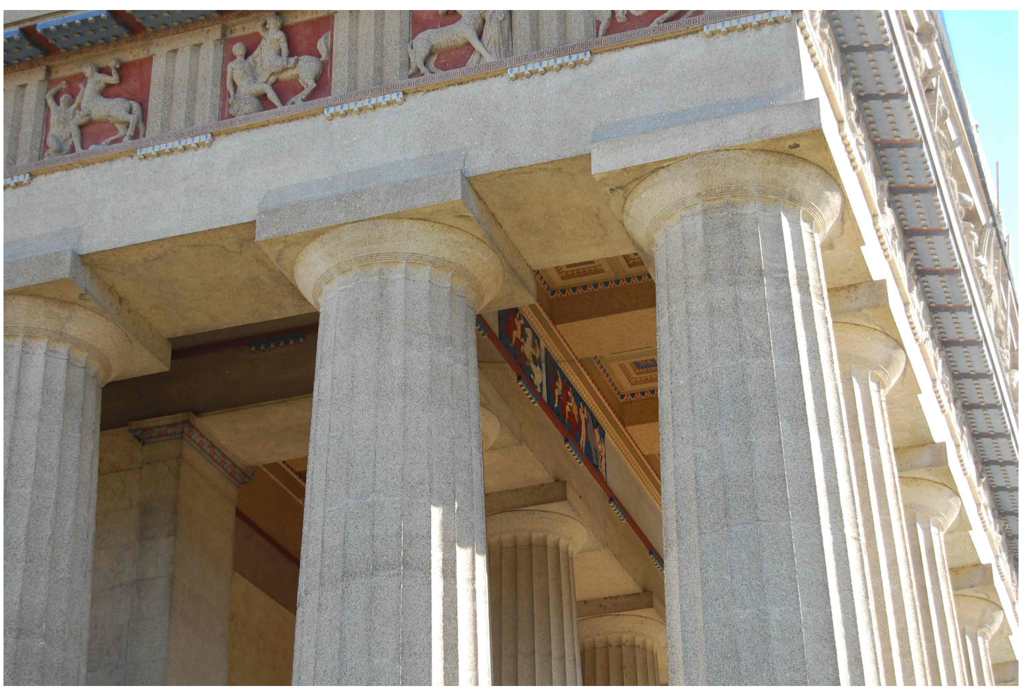


Figure 3.25 The frieze panels installed. (All Images: Cupello)
A. the pteroma,
B. approximately 30 ft from the base of the stylobate
C. The North side of the building.

A.

B.

Figure 3.26

A. Visitors to the Nashville Parthenon complete the survey. (Image: Cupello)
B. Visitors at the Nashville Parthenon on the day of the experiment (Image: Cupello)

Works Cited

Abbe, Mark B. "Heilbrunn Timeline of Art History." Polychromy of Roman Marble Sculpture. 2000. Accessed April 2013. http://www.metmuseum.org/toah/hd/prms/hd_prms.htm.

Abbe, Mark B. "Recent Research on the Painting and Gilding of Roman Marble Statuary at Aphrodisias." In Brinkmann, Primavesi, and Hollein 2010, 277-289.

"Acropolis Restoration Service." Acropolis Restoration Project. Accessed April 2013.

Ashmole, Bernard. *Architect and Sculptor in Classical Greece*. New York: New York University Press, 1972.

Barrow, R. J. *Lawrence Alma-Tadema*. London: Phaidon Press, 2001.

Beard, Mary. *The Parthenon*. Cambridge, MA: Harvard University Press, 2010.

Besques, Simone. *Figurines et Reliefs Grecs en Terre Cuite*. Paris: Réunion des Musées Nationaux, 1994.

Bourgeois, Brigitte, and Philippe Jockey. "The Polychromy of Hellenistic Marble Sculpture in Delos." In In Brinkmann, Primavesi, and Hollein 2010, 224 - 239.

Brecoulaki, Hariclia. *La Peinture Funéraire de Macédoine: Emplois et Fonctions de la Couleur : IVe - IIe S. Av. J.-C*. Athènes: Centre de Recherches de L'Antiquité Grecque et Romaine, Fondation Nationale de la Recherche Scientifique, 2006.

Brinkmann, Vincenz. "Statues in Color: Aesthetics, Research, and Perspectives." In Brinkmann, Primavesi, and Hollein 2010, 10-23.

Brinkmann, Vinzenz, Oliver Primavesi, and Max Hollein, eds. *Circumlitio: The Polychromy of Antique and Mediaeval Sculpture*. Munich: Hirmer, 2010.

Brinkmann, Vincenz, and Ulrike Koch-Brinkmann. "On the Reconstruction of Antique Polychromy Techniques." In Brinkmann, Primavesi, and Hollein 2010, 114 - 135.

Brinkmann, Vinzenz, Eike D. Schmidt, Roberta Panzanelli, and Kenneth D. S. Lapatin. *The Color of Life: Polychromy in Sculpture from Antiquity to the Present*. Los Angeles: J. Paul Getty Museum, 2008.

Bruno, Vincent J. *Form and Color in Greek Painting*. New York: Norton, 1977.

"Circumlitio." Lewis and Short Latin Dictionary. Accessed April 2013. http://www.latin-dictionary.net/definition/9961/circumlitio-circumlitionis.

Cohen, Beth. *The Colors of Clay: Special Techniques in Athenian Vases*. Los Angeles: J. Paul Getty Museum, 2006.

Coulton, J.J. “Fitting friezes: architecture and sculpture” in Periplous *: papers on classical art and archaeology presented to Sir John Boardman,*ed. G. R. Tsetskhladze, A. J. N. W. Prag and A. M. Snodgrass, London: Thames and Hudson, 1976, 70-79.

Creighton, Wilbur F., and Leland R. Johnson. *The Parthenon in Nashville*. Nashville, TN: JM Productions, 1989.

Dinsmoor, William B. "Attic Building Accounts I. The Parthenon." *American Journal of Archaeology* 17, no. 1 (1913), 53-80.

Gurewitsch, Matthew. "True Colors." Smithsonian Magazine. 2007. Accessed April 2013. http://www.smithsonianmag.com/arts-culture/true-colors.html.

Hittorff, Jacques Ignace. *Restitution Du Temple D'Empédocle à Sélinonte Ou L'Architecture Polychrôme Chez Les Grecs*. Paris: Didot, 1851.

Hölscher, Tonio. "Architectural Sculpture: Messages? Programs? Towards Rehabilitating the Notion of ‘Decoration." In *Structure, Image, Ornament: Architectural Sculpture in the Greek World. Proceedings of an International Conference Held at the American School of Classical Studies, 27-28 November 2004*. Oxford/Oakville: Oxbow Books, 54-67, 2009.

Hurwit, Jeffrey M. *The Athenian Acropolis: History, Mythology, and Archaeology from the Neolithic Era to the Present*. Cambridge: Cambridge University Press, 1999.

Jenkins, Ian. *Greek Architecture and Its Sculpture*. Cambridge, MA: Harvard University Press, 2006.

Jenkins, Ian D., and A. P. Middleton. "Paint on the Parthenon Sculptures." *The Annual of the British School at Athens* 83 (1988),183-207.

Kakoulli, Ioanna. *Greek Painting Techniques and Materials from the Fourth to the First Century BC*. London: Archetype, 2009.

Katsaros, T. Ioannis Liritzis and N. Laskaris, “Identification of Theophrastus’ pigments *egyptios yanos* and *psimythion* from archaeological excavations,” 2010. http://archeosciences.revues.org/2632

Kondaratos, Savas. “The Parthenon as Cultural Ideal,” *The Parthenon and Its Impact in Modern Times*. ed. Tournikiotis, Athens: Melissa, 1994, 18-53.

Korres, M. *From Pentelicon to the Parthenon: The Ancient Quarries and the Story of a Half-worked Column Capital of the First Marble Parthenon*. Athens: Melissa, 2001.

Lawrence, A. W. *Greek and Roman Sculpture*. New York: Harper & Row, 1972.

Liverani, Paolo. “New Evidence on the Polychromy of Roman Sculpture.” In Brinkmann, Primavesi, and Hollein 2010, 290-302.

Marconi, Clemente. "The Parthenon Frieze: Degrees of Visibility." *RES: Anthropology and Aesthetics* 55/56 (2009): 156-73.

Neils, Jenifer. *The Parthenon Frieze*. Cambridge: Cambridge University Press, 2001.

Neils, Jenifer. *The Parthenon: From Antiquity to the Present*. Cambridge, UK: Cambridge University Press, 2006.

Oakley, John Howard. *Picturing Death in Classical Athens: The Evidence of the White Lekythoi*. Cambridge, U.K.: Cambridge University Press, 2004.

Osborne, Robin. "The Viewing and Obscuring of the Parthenon Frieze." *The Journal of Hellenic Studies* 107 (1987): 98-105.

Ostergaard, Jan Stubbe. "The Copenhagen Polychromy Network: A Research Project on Ancient Greek and Roman Sculptural Polychromy in the Ny Carlsberg Glyptotek." In Brinkmann, Primavesi, and Hollein 2010, 324 - 336.

Ostergaard, Jan Stubbe. "The Polychromy of Antique Sculpture: A Challenge to Western Ideals?" In Brinkmann, Primavesi, and Hollein 2010, 78-107.

Palagia, Olga, and J. J. Pollitt. *Personal Styles in Greek Sculpture*. Cambridge: Cambridge University Press, 1999.

Pandermalis, Dimitrios, ed. *Archaic Colors*. Athens: Acropolis Museum, 2012.

Pollitt, J. J. *The Art of Ancient Greece: Sources and Documents*. Cambridge University Press, 1990.

"The Polychromy of Greek and Roman Sculpture." Copenhagen Polychromy Network. Accessed April 2013. http://www.trackingcolour.com.

Prater, A. "The Rediscovery of Colour in Greek Architecture and Sculpture." In *The Color of Life: Polychromy in Sculpture from Antiquity to the Present*. Los Angeles: Getty Publications, 2008.

Primavesi, Oliver. "Artemis, Her Shrine, and Her Smile: Winkelmann's Discovery of Ancient Greek Polychromy." In Brinkmann, Primavesi, and Hollein 2010, 24 -77.

Quatremère De Quincy, A.C. *Le Jupiter Olympien; Ou, L'art De La Sculpture Antique*. Paris: Chez De Bure Frères, 1815.

Rohde, Elisabeth. *Griechische Terrakotten*. Berlin: Verlag Ernst Wasmuth Tubingen, 1968.

Richter, Gisela Marie Augusta. "Polychromy in Greek Sculpture." *Metropolitan Museum of Art Bulletin*, New ser., v. 2, no. 8 (April, 1944), 233-420.

Ridgway, Brunilde Sismondo. *Prayers in Stone: Greek Architectural Sculpture Ca. 600-100 B.C.E.* Berkeley: University of California Press, 1999.

Semper, Gottfried. *Vorläufige Bemerkungen über Bemalte Architectur Und Plastik Bei Den Alten*. Hammerich, 1834.

Shear, Julia Louise. *Polis and Panathenaia: The History and Development of Athena's Festival*. Diss., University of Pennsylvania, 2001.

Siebler, Michael, and Norbert Wolf. *Greek Art*. Cologne: Taschen, 2007.

"Sir Aurel Stein & the Silk Road Finds - Astana." Victoria and Albert Museum. Accessed April 2013. http://www.vam.ac.uk/content/articles/t/the-silk-road-finds-map-1/.

Sisa, József. "Joseph Hoffer and the Study of Ancient Architecture." Journal of the Society of Architectural Historians, Vol. 49, No. 4 (Dec., 1990), 430-439.

Smith, Tyler Jo, and Dimitris Plantzos. *A Companion to Greek Art*. Malden, MA: Wiley-Blackwell, 2012.

Stevens, Gorham. "The Periclean Entrance Court of the Acropolis of Athens," Hesperia: The Journal of the American School of Classical Studies at Athens, Vol. 5, No. 4 (1936), 443-520.

Stillwell, Richard. "The Panathenaic Frieze." *Hesperia* 38, no. 2 (1969): 231-41.

"Storage Jar with the Judgment of Paris (Getty Museum)." Getty Museum. Accessed April 2013. http://www.getty.edu/art/gettyguide/artObjectDetails?artobj=12329.

Stuart, James, Nicholas Revett. *The Antiquities of Athens*. fwd. Frank Salmon, New York: Princeton Architectural Press, 2008.

Tyler, Ilene R. "Replicating the John J. Earley Concrete Mix to Restore the Nashville Parthenon." *Association for Preservation Technology Bulletin* 35, no. 2/3 (2004), 43-50.

"The Parthenon." Nashville Parks and Recreation. Accessed April 2013. http://www.nashville.gov/Parks-and-Recreation/Parthenon.aspx.

Tournikiotis, Panayotis. *The Parthenon and Its Impact in Modern Times*. Athens: Melissa, 1996.

Van Zanten, David. "The Parthenon Imagined Painted." In *The Parthenon and Its Impact in Modern Times*, edited by P. Tournikiotis, Athens: Melissa, 1996, 258-277.

Vlassopoulou, Christina, "History of the Research on Polychromy in Sculpture." In *Archaic Colors*. Athens: Acropolis Museum, 2012.

Vlassopoulou, Christina. "New Investigations into the Polychromy of the Parthenon." In Brinkmann, Primavesi, and Hollein 2010, 218 -223.

Winckelmann, Johann Joachim, *History of the Art of Antiquity*, fwd. Alex Potts, Los Angeles, CA: Getty Research Institute, 2006.

Works Consulted

Abbe, Mark B. "Re-contextualizing the 'Karg-Bebenburg Youth': Marble Technique, Polychromy, and Sculptural Style." *Annual Meeting of the Archaeological Association of America*, Anaheim.2010.

"Ancient Colour Revealed on the Parthenon Sculptures." British Museum. Accessed April 2013. http://www.britishmuseum.org/explore/highlights/articles/a/ancient_colour_on_parthenon.aspx.

"Ancient Infrared-Emitting Egyptian Pigment Could Be Useful as Nano-Ink: Scientific American." Scientific American. Accessed April 2013. http://www.scientificamerican.com/article.cfm?id=ancient-infrared-emitting-egyptian-pigment-could-be-useful-as-nano-ink.

Andronikos, Manolēs. *Vergina: The Royal Tombs and the Ancient City*. Athens: Ekdotike Athenon, 1991.

Boardman, John. *Greek Sculpture: The Classical Period : A Handbook*. New York, NY: Thames and Hudson, 1985.

Boardman, John. *The Parthenon and Its Sculptures*. Austin: University of Texas Press, 1985.

Brinkmann, Vinzenz, and Andreas Scholl. *Bunte Götter: Die Farbigkeit Antiker Skulptur*. München: Hirmer Verlag, 2010.

Brommer, Frank. *Der Parthenonfries*. Mainz Am Rhein: Von Zabern, 1977.

Brommer, Frank. *The Sculptures of the Parthenon*. London: Thames and Hudson, 1979.

Emerson, Ralph Waldo, and Peter Washington. *Emerson: Poems*. New York: Everyman's Library, 2004.

"Heilbrunn Timeline of Art History." Panathenaic Prize Amphora (14.130.12). Accessed April 2013. http://www.metmuseum.org/toah/works-of-art/14.130.12.

Hitchens, Christopher, Robert Browning, and Charalampos Bouras. *The Parthenon Marbles: The Case for Reunification*. London: Verso, 2008.

Hurwit, Jeffrey M., Adam D. Newton, and Jeffrey M. Hurwit. *The Acropolis in the Age of Pericles*. Cambridge, UK: Cambridge University Press, 2004.

Jenkins, Ian, and Kate Morton. *Explore the Parthenon: An Ancient Greek Temple and Its Sculptures*. London: British Museum Press, 2009.

Jenkins, Ian D. *Parthenon Frieze*. London: British Museum, 2002.

Jenkins, Ian. *The Parthenon Sculptures*. Cambridge, MA: Harvard University Press, 2007.

Korres, M. *Stones of the Parthenon*. Los Angeles: J. Paul Getty Museum, 2000.

Lawrence, A. W., and R. A. Tomlinson. *Greek Architecture*. New Haven: Yale University Press, 1996.

Le Corbusier, and Frederick Etchells. *Towards a New Architecture,*. London: Architectural Press, 1946.

Linton, Harold. *Color in Architecture: Design Methods for Buildings, Interiors, and Urban Spaces*. New York: McGraw-Hill, 2003.

Lydakēs, Stelios. *Ancient Greek Painting and Its Echoes in Later Art*. Los Angeles, CA: J. Paul Getty Museum, 2004.

Marconi, Clemente. *Temple Decoration and Cultural Identity in the Archaic Greek World: The Metopes of Selinus*. Cambridge: Cambridge University Press, 2011.

"New Test Reveals Parthenon's Hidden Colour." New Scientist. Accessed April 2013. http://www.newscientist.com/article/dn17309-new-test-reveals-parthenons-hidden-colour.html.

Palagia, Olga. *Greek Sculpture: Function, Materials, and Techniques in the Archaic and Classical Periods*. Cambridge: Cambridge University Press, 2008.

Pantermalēs, Dēmētrios. *The New Acropolis Museum*. Skira Rizzoli, 2013.

Panzanelli, Roberta, Eike D. Schmidt, and Kenneth D. S. Lapatin. *The Color of Life: Polychromy in Sculpture from Antiquity to the Present*. Los Angeles: J. Paul Getty Museum, 2008.

"The Parthenon Frieze." The Parthenon Frieze. Accessed April 2013. http://www.ekt.gr/parthenonfrieze_text_version/index.jsp?lang=en.

"The Parthenon Sculptures." British Museum. Accessed April 2013. http://www.britishmuseum.org/about_us/news_and_press/statements/parthenon_sculptures.aspx.

Robertson, Martin, and Alison Frantz. *The Parthenon Frieze*. New York: Oxford University Press, 1975.

Root, Margaret Cool. "The Parthenon Frieze and the Apadana Reliefs at Persepolis: Reassessing a Programmatic Relationship." *American Journal of Archaeology*, Vol. 89, No. 1, Centennial Issue (Jan., 1985).

Schultz, Peter, and Ralf Von Den. Hoff. *Structure, Image, Ornament: Architectural Sculpture in the Greek World : Proceedings of an International Conference Held at the American School of Classical Studies, 27-28 November 2004*. Oxford: Oxbow Books, 2009.

Solon, Léon Victor. *Polychromy; Architectural and Structural, Theory and Practice,*. New York: Architectural Record, 1924.

Stevens, Gorham. “Architectural Studies Concerning the Acropolis of Athens,” *Hesperia: The Journal of the American School of Classical Studies at Athens* , Vol. 15, No. 2, The Twenty-Eighth Report of the American Excavations in the Athenian Agora (Apr. - Jun., 1946), pp. 73-106Gorham P. Stevens, “Concerning the Impressiveness of the Parthenon,” American Journal of Archaeology, Vol. 66, No. 3 (Jul., 1962), 337-338.

Gorham P. Stevens, “The Setting of the Periclean Parthenon,” Hesperia Supplements, Vol. 3,1940, 1-91.

Stewart, Andrew F. *Classical Greece and the Birth of Western Art*. Cambridge: Cambridge University Press, 2008.

Primary Sources

Aeschylus, *Persians ; Seven against Thebes; The Suppliants ; Prometheus Bound*. Trans. Alan H. Sommerstein. Cambridge, Mass: Harvard University Press, 2008.

Aristotle, *The Athenian Constitution; The Eudemian Ethics; On Virtues and Vices*. Trans. Harris Rackham. Cambridge, Mass.: Harvard University Press, 2004.

Pliny, *Natural Histories*. Trans. H. Rackham. Cambridge, Mass: Harvard University Press, 1938.

Plutarch, *Lives: Pericles and Fabius Mazimus, Nicias and Crassus*. Cambridge. Trans. Bernadotte Perrin, Cambridge, Mass: Harvard University Press, 1984.

Plutarch, *Plutarch's Cimon and Pericles, with the Funeral Oration of Pericles (Thucydides, II, 35-46)*. Trans. Bernadotte Perrin, New York: C. Scribner's Sons, 1910.

Theophrastus, *Theophrastus on Stones.* Trans. John F. Richards, and Earle Radcliffe Caley, Columbus, OH: Ohio State University, 1956.

Vitruvius, Pollio, *Ten Books on Architecture*. Trans: Ingrid D. Rowland, Thomas Noble Howe, and Michael Dewar, New York: Cambridge University Press, 1999.

Appendices

Appendix 1: Emory Parthenon Frieze Project Team

My sincerest thanks go out to the members of the Emory Parthenon Project Team and the staff of the Nashville Parthenon for allowing this study to occur. Particularly, I am grateful to Mrs. Wesley Paine, the director of the Nashville Parthenon and to Mrs. Deegee Lester, director of Education at the Nashville Parthenon.

Supervisor: Dr. Bonna Wescoat, Professor of Art and Archaeology

Emory Laney Graduate School:
- Jane Arney
- Catherine Barth
- Shelley Burian
- Jennifer Butterworth
- Katherine Cupello
- Alison Hight
- An Jiang
- Kira Jones
- Joanna Mundy

Emory College:
- Hugh H. W. Green
- Rebecca Levitan
- Rebecca McManus
- Hannah Smaugh

Other Emory Team Members:
- Hal Jacobs
- Dr. Cynthia Patterson
- Dr. Richard Patterson

Michael C. Carlos Museum, Emory University
- Dr. Jasper Gaunt
- Elizabeth Hornor

Georgia Institute of Technology:
- Robin Prater

Vanderbilt University:
- Dr. Barbara Tsakirgis

Appendix 2: Sample Survey

VIEWING THE PARTHENON FRIEZE

The Athenian Parthenon is one of the world's most celebrated buildings. Its continuous sculptured frieze, which once wrapped around the top of the wall, is an icon of world art. Today we can admire the frieze panels at eye level in museum settings (in London, Paris, and Athens), with perfect lighting conditions that let us see every splendid detail.

Viewing the frieze on the original building was an entirely different experience. It was set high above eye-level, at the top of the cella wall behind the surrounding colonnade. Scholars are baffled by the location: Why did the ancient designers put the frieze up so high? How well could it be seen? These questions have been hard to answer because the frieze is no longer on the original Parthenon and the Parthenon no longer has its ceiling and roof.

However, the Nashville Parthenon is a splendid 1:1 replica of the Parthenon in Athens, and it DOES have its ceiling and roof. So we decided to test the visibility of the Parthenon frieze here in Nashville. Because the Nashville Parthenon does not have the frieze currently installed, we have recreated several panels from the original north and west sides. Today they are hanging in their "original" positions on the building.

We would like to invite you to participate in a short survey to help us understand how well people can see the famous frieze on the building. All you need to do is go to the three "stations" marked by signs, pick up color-coded flags, and respond to the questions on the survey. Students wearing navy Emory tee-shirts are at each station to help and to answer questions. The survey should only take you about 10-15 minutes to complete.

This survey is voluntary and your responses will be anonymous. We will only look at the data in the aggregate.

Many thanks for contributing to our understanding of this world heritage monument!

BACKGROUND KNOWLEDGE

1) Have you ever visited the Parthenon in Athens?

YES NO

2) Have you ever seen the Parthenon frieze (Elgin Marbles) in the British Museum?

YES NO

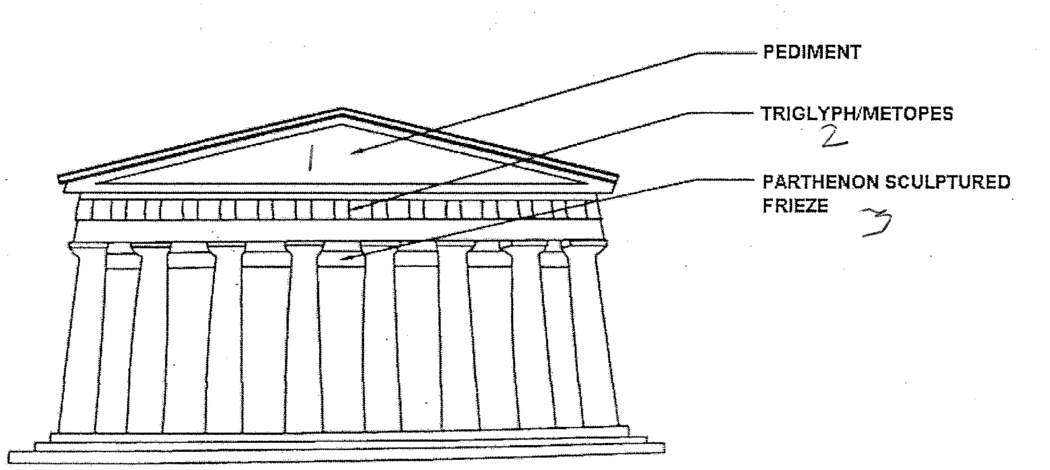
3) Have you ever studied the Parthenon and its sculpture?

NO A LITTLE EXTENSIVELY

4) How often do you come to the Nashville Parthenon?

FIRST TIME A FEW TIMES BEFORE FREQUENTLY

Department of Art History, Emory University



STATION 1: APPROACHING THE BUILDING AND VISIBILITY OF THE FRIEZE

1) Start walking along the "Panathenaic Way" (marked in paint on the ground). When you can best see the inner painted frieze, plant your **GREEN** flag. You can move off the path to plant the flag.

2) As you continue to move toward the building, put your **RED** flag where it becomes hard or uncomfortable to see the frieze. If you are inside the walkway of the building, we can tape your flag down.

STATION 2: TAKING THE BUILDING HEAD ON

Please move to Station #2 in front of the west end of the building.

3) The Parthenon has three types of sculpture: the pediment, the metopes, and the frieze (see diagram). On the diagram, mark 1 for the sculpture you notice first, 2 for what you see second, and 3 for what you see third.

4) As you move straight towards the building, plant your **ORANGE** flag where it becomes hard or uncomfortable for you to see the **pediment and the metopes**.

5) As you move toward the building, put your **GREEN** flag where you can best see the **Parthenon sculptured frieze**.

6) Move along the Parthenon to view the panels. Observe the horses and riders.

Do they make you want to move in a particular direction?

1	2	3	4	5
No		a little		yes

7) How much do the columns block your view of the frieze?

1	2	3	4	5
Not at all		a little		a lot

8) Do the columns help you focus on parts of the frieze?

1	2	3	4	5
Not at all		a little		a lot

9) Do the figures in the frieze make you want to move around the corner?

1	2	3	4	5
Not at all		a little		a lot

STATION 3: THE POWER OF COLOR

Please go to Station #3.
Move along the Parthenon to view the panels. Then answer the questions below.

10) How many colors of horses can you see? ______________________________

11) How clearly can you distinguish the horses against the background?

1	2	3	4	5
Not at all				clearly distinct

12) How clearly can you distinguish the people against the background?

1	2	3	4	5
Not at all				clearly distinct

13) Please indicate on the chart below how well you can see each color in the panels.

Color	1- Not at all	2	3	4	5-Clearly distinct
Blue					
Red					
Yellow					
Green					
Gray					
Black					
Flesh tone					
Reddish Brown					
Dark Brown					
White					

14) Please indicate on the chart below how well you can see details in the panels

	1 Not at all	2	3	4	5 Clearly distinct
Facial features	✓				
Men's footwear	✓				
Horses' bridles and reins			✓		
Veins on the horses	✓				

15) Go to the "Question 15" sign. Look at the two panels directly in front of you. On which panel can you see the figures most clearly?

LEFT RIGHT

16) Does the relief on the right panel make a difference to the visibility of the figures?

1	2	3	4	5
Not at all		some		a lot

FINAL THOUGHTS

17) Does this frieze change your idea of the Nashville Parthenon or the Athenian Parthenon? Please answer in a few words.
NASHVILLE – DUE TO MY limited knowledge – NO

TELL US ABOUT YOURSELF

Gender: Male ✓ ______ Female ______ Trans ______

Age: under 18 ______
19-25 ______
26-35 ______
36-45 ______
46-55 ✓ ______
56 and over ______

THANKS!

Department of Art History, Emory University

Appendix 3: Written Responses in "Final Thoughts" Section of the Survey.

Participants were given the option of including a statement as to whether the exercise changed their idea of the Nashville Parthenon or the Athenian Parthenon.

Of those who filled out this question, 67% responded positivity and said the experiment made them re-evaluate their idea of at least one of the buildings. The responses are included below. The numbering is based on the order in which the surveys were processed and is arbitrary in regards to the experiment.

1. Nashville - Due to limited knowledge, No

2. Yes, the building was meant to be experienced differently from different vantage points

3. Yes, it is much more visible than I would have thought

4. Yes, it makes me aware of the huge difference angle of the sun makes to the legibility of the frieze's colors. As sun descends, colors become harder to pick out, but the human figures and lighter horses still stand out from dark background by virtue of the contrast

7. Its neat.

8. Yes, I never realized it. It brought my eyes to attention. Really liked it!

9. Yes, never paid attention when walking by. Now the color stands out which is nice.

10. I can see it clearer than I thought.

11. Yes, more detailed than I would have guessed.

13. Would add great artistic detail and adventure.

14. It was an interesting exercise

17. I never noticed this before today

19. No, I was unfamiliar before.

20. Yes, it makes the experiment much more dynamic and emphasizes the vitality inherent in ancient architecture.

21. Yes, It's very interest to see how visible the frieze would have been in certain places, especially with the addition of color and relief.

23. not really

24. Fantastic! Yet another example of how the architect thought of everything and was completely aware of the visitor's experience. I guess that's not so much a change as an affirmation.

25. Yes, although it has been many years since I considered the Parthenon, I did not remember any painting.

26. No, I had no expectations prior to seeing the Parthenon

27. More interesting, creates greater attention

28. yes, it adds interest, drew my attention, made me want to stay and look longer

29. I would like to see the Nashville Parthenon be as accurate as possible.

30. Yes it does, it makes the already impressive architectural achievement even more so.

31. Yes, it makes it more interesting.

32. Not really, I don't know about it.

33. It brought out details

35. It gives an interesting and thoughtful view.

37. No, to me it creates a more interesting map of the story

38. I have never believed it was not visible – this confirms how integrated the composition is to the architectural placement. It would be interesting to conduct this experiment/survey at different times of day and in different lights to see how that changes the visibility.

41. No, no strong ideas before

43. Didn't have any ideas first time to see! Great piece of history

44. I can see it very well

45. The frieze makes the Parthenon look more like a replica and … it helps to learn about what the Parthenon would ave looked like.

46. Yes, the colors are very distinct and visible. However, how would the gleaming white marble of the Athenian Parthenon have impacted the viewing experience. The dull concrete of the Nashville Parthenon contrasts well with the colors, but how would bright white marble contrast?

47. No, did not have any preconceptions

48. I like attention to detail and it claiming to be a replica. I find that detail is essential. It is visible, and adds to the exterior of the building in an exact manner.

51. I haven't seen or studied either really, so no.

54. It gives the Parthenon more color and character.

57. I must say, I have a new appreciation for the craftsmanship and architectural genius behind the Parthenon.

60. Yes, I didn't realize the 1;1 scale allowed for experiments like this.

61. Presents and interesting and mysterious question

62. Color and detail help you look longer.

67. First time, no change.

68. Its interesting to think that it would have been painted instead of just white. It makes their culture seem more real and closer to ours.

69. Yes, the degree of visibility is even higher than I expected.

70. Yes, Color Matters!

72. We need the frieze on the building!

73. Enjoyed this project participation. It was interesting to learn more of the history. Will be interested to see this landmark again.

75. More colorful, more aesthetically pleasing.

77. It was surprising to see that the frieze is visible and the figures are discernable.

78. The color is wonderful!

79. Yes, the color and placement on the building itself adds a whole new dimension

80. Not the subject of the frieze but its placement on the Parthenon makes both the Nashville and Athenian versions more interesting. Clearly it was planned even more detailed than I first imagined.

81. We never knew there were paintings so now we know and can imagine. Thank you

83. This was been one of the greatest events at the Parthenon. I have often wondered how the frieze would have looked and what the Athenians were seeing. Thanks a million!

84. It has more detail and more interest than previously thought.

85. Yes, I like it more and didn't know the Parthenon Frieze existed.

86 Yes, I did not know the frieze existed.

87. I believe it had an original purpose to draw the observer to view the entire Parthenon.

88. yes, interesting because I didn't know much about it.

89. Great addition. How much for the full set?

90. Since I had no previous opinion no. But the frieze is beautiful and adds to the experience.

91. Yes, the sculptors were depicting time and motion in stationary panels – that's advanced.

92. The Parthenon certainly seems to have been more colorful than I thought.

94. Yes, I had no thought about the significance of each aspect of the monumental temple.

Appendix 4: Further Information on the Emory Parthenon Project

Blog:
The Emory Parthenon Frieze Project has a blog, which documents the evolution of the project.
blogs.emory.edu/parthenonproject/

Video:
A documentary about the experiment entitled "Seeing is Believing: Emory Students Shed New Light on the Parthenon Frieze" was made by videographer Hal Jacobs and can be accessed on YouTube
https://www.youtube.com/watch?v=RauBAZYLJ2A

The video debuted at the American School of Classical Studies Archaeological Film Festival. More information about that event can be found here:
http://www.ascsa.edu.gr/index.php/news/eventdetails/archaeological-film-festival

Press:
Several articles have been written about the Emory Parthenon Frieze Project:

The Nashville Tennesean
http://www.tennessean.com/VideoNetwork/1960837991001/Emory-University-tries-to-solve-Parthenon-mystery

The Emory Wheel
http://www.emorywheel.com/project-replicates-greek-parthenon/

Emory E-Science Commons Blog
http://esciencecommons.blogspot.com/