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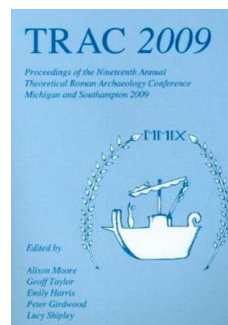
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The Herculaneum Amazon: Sculptural Polychromy, Digital Simulation and Context

Gareth Beale and Graeme Earl

Introduction

The research introduced in this paper and which forms the background to the ongoing Herculaneum Amazon project seeks to build upon ongoing work in the area of sculptural polychromy and on the simulation and analysis of sculpture in context (Happa *et al. in press*; Happa *et al.* 2009 Earl *et al.* 2009; Earl *in press*; AmazonWeb 2009). It is focussed on creating computer-based, virtual rather than physical representations of Roman statues in simulated Roman environments. In occupying a virtual, as opposed to actual space, these reconstructions not only provide physically accurate simulations of statues but also inform considerations of space, light and sculptural polychromy that relate to environments that no longer exist and which would be difficult or impossible to recreate. Specifically, by moving into the virtual it becomes possible to contextualise – to begin to consider the ways in which environments influence the visual qualities of polychrome statuary and to consider the implications of context on the ways in which the objects may have been lit. The use of virtual objects and virtual environments provides an unrivalled opportunity for experimentation and plurality. But it has only been with the recent advent of computer algorithms derived for the film and entertainment industries, including specifically physically accurate lighting models and surface materials, that work of this type has been possible. This paper will discuss recent attempts to produce physical replicas of sculptural polychromy, consider the changing status of polychromy in the study of Roman statues, and identify the potential for digital modes of sculpting and repainting the past. This paper concentrates on marble statues and, in particular, on the Amazon discovered in the Basilica Noniana at Herculaneum (Fig. 1). However, the arguments presented here are, in many aspects, equally relevant to the study of bronze and to polychrome statuary from across the Roman world.



Figure 1: A virtual simulation of the Amazon head discovered at Herculaneum in 2006 (© Gareth Beale ACRG).

Visualising statues

We are used in archaeology to interpreting subtle changes in human intentionality over time. Whether carefully excavating the layers of a midden looking for changes in patterns of disposal or untangling complex urban architecture, the essence of archaeology lies in observing and constructing the changing nature of human interaction with the material world. Some of the most compelling examples of human intentionality made material can be found amongst the canon of surviving Roman statuary. These bold statements in marble frequently bear the scars of centuries of reinvention and rediscovery. In spite of this, the tendency for many years was to view the Roman statue as static, unyielding and pristine. All too often the viewer was encouraged to think in terms of ancient survivals that came into existence at the moment the chisel was put down and which found their way to us unchanged but for the wear and tear of millennia. But of course such statues have changed, as people have changed around them. The creation of the discipline of Classical Art History and subsequent definitions of lexica and modes of thinking about classical art communicated a specific range of conceptualisations of Roman statuary, conceptualisations rooted not in the Roman past but in the modern world (Stewart 2003; Østergaard 2008).

In order to develop insightful methods of considering the meanings which have shaped Roman statuary it is necessary to acknowledge our distance from the act of creation and to accept that we can only have a limited concept of the original meaning of statuary without an attempt to untangle the nexus of social, personal and inter-personal contexts that resulted in their creation and re-invention. Statues, then, are not miraculously preserved leftovers from a world which has long gone, but rather contemporary objects which have been subject to, and are records of, the interpretations and decisions of all who have come into contact with them. We argue that the creation of digital surrogates to these statues is therefore a further continuation in their life history.

If we are to begin to think about Roman statuary in these terms then it is imperative that we consider the significance of colour. Despite a traditional disinterest amongst scholars, the fact that a great deal of Roman marble statuary was artificially coloured has not only been recognised but has become the focus of research across a range of disciplines (e.g. Østergaard 2008; Elsner 2007; Bradley 2009; Potts 2008). Whilst rejecting a conceptualisation of the statue as a static object, the fact remains that marble is more hardy and stable than the painted and treated surfaces which might have adorned its surface. Developments in the study of sculptural polychromy therefore provide a window into a potentially more fluid component to a statue's life history. In turn we may consider the acts of visual perception informing the creators, from the sculptor to the painter, and all of those who engaged with and, as such, helped to form these objects.

Visualisations of various kinds have been employed by scholars for as long as polychrome statuary has been an object of study. These visualisations have taken a number of forms, including early attempts at the recreation of coloured examples such as Gibson's Tinted Venus, first displayed at the London International Exhibition of 1862 (Bradley 2009). Other examples have included the coloured engravings of Augustus from Prima Porta created by Georg Treu for Ludwig Fenger's (1886) volume *Dorische Polychromie*. A more recent work of coloured illustration can be found in Reuterswärd's (1960) volume *Studien zur Polychromie der Plastik: Griechenland und Rom*. These volumes made a great contribution to the study of sculptural polychromy and can provide specific insights into evidence which has now been lost. However, in terms of illustrative technique there are several factors which limit the usefulness

of these volumes. Neither Fenger nor Reuterswård had access to technology which would allow them to record or accurately represent coloured pigments or surface finishes. As such these illustrations, and the literature accompanying them, may be understood and critiqued as illustrations rather than replicas.

More recent moves to represent sculptural polychromy have employed an approach that relates the visualisation more closely to imagined Roman originals, at least in terms of physical composition and application of paint. A series of pan-European collaborations (including contributions from the Copenhagen Glyptotek, Vatican Museum, Munich Glyptotek and others) have applied advanced scientific techniques to efficiently record and analyse a series of statues with polychrome components. They have used these data to reproduce the statues physically using chemically reconstructed pigment and statues. The greatest contribution of this work has been the demonstrably accurate reproduction of colour and surface, leading to high fidelity representations (Østergaard 2008; Liverani 2004). Together these lend the representations a scientific accountability which has, up until now, been absent. Perceptually based interpretations of sculptural polychromy in context can only develop from such physically-bounded surrogates.

Our virtual approach to sculptural polychromy builds on this body of physically-accurate recreation, and has the potential to provide additional benefits. Crucially, in the world of the virtual, sculptural ambiguities can be investigated at very little additional cost. One might create eight statues, all of which are identical apart from the composition or tint of the wax used to treat the surface of the marble.

Statues in a 'pristine' state

The widely held and, in the West, culturally engrained notion of the classical white statue has been addressed by a number of authors (e.g. Østergaard 2008; Brinkmann 2004; Liverani 2004; Bradley 2009; Elsner 2007; Stewart 2003). The issue of colour is of great interest not simply because it has the potential to change our perception of statuary but because it shines a light on the past of those disciplines which have had a hand in creating the notion of a pristine, monochrome canon. As such it may give insights as to how we should advance and how we might modify the ways in which we consider statuary.

The inception of monochrome as the norm for Roman statuary can be traced back to Winckelmann (Gordon 1979; Østergaard 2008; Holscher 2004). Gordon identifies the significance of Winckelmann in the creation of Classical Art History as a formalist discipline which sought to categorise and rationalise material rather than seek to understand the conditions of its creation. To Gordon, Winckelmann's influence serves to compartmentalise all that can be considered to be classical 'art' into a discrete category, equivalent to contemporary definitions of art and often subject to the same modes of criticism (Gordon 1979:5). Furthermore, according to Østergaard, it is this separateness which allowed Classical Art History to become permeated with "neo-classical notions of a monochrome aesthetic in classical sculpture" (Østergaard 2008: 40). Essentially then, we see classical sculpture drawn in to the modern, in terms of the language and ideas which infuse its study, its analysis and in terms of the buildings within which the statues were contained (Hingley 2000: 78). The extent to which Roman statuary can be seen to have been subsumed by modern aesthetic sensibilities is demonstrated effectively by the case of the Townley Discobolus. During the restoration of this statue the restorer opted to replace the head facing forward, rather than backwards toward the throwing arm, as would have been the case in the original (Beard and Henderson 2001: 88).

At a later date Vatican restorers judged this to be the superior interpretation and later statues were restored in the same fashion.

The effect of this process on academic discourse was that the statue became divorced from polychromy in the interpretive consciousness of all but a few who continued to study in this field. The extent to which this connection was severed can be seen in the reactions of those who come into contact with examples or representations of painted classical statuary. Reactions have varied from the “causing [of a] sensation” of Gibson’s Tinted Venus (Bradley 2009), to hostility to the recent repainting of a replica of the statue of Augustus from Prima Porta (Østergaard 2008:40), to media excitement surrounding the opening of the recent *Gods in Colour* Exhibition (Gopnik 2008).

Wincklemann’s impact then was to make the statue something at once iconic and homogeneous. As the colour was lost so were insights into what the statue meant as an individual object with a unique past. At the same time, the aesthetic concept of the statue in white marble took hold. In failing to consider the creative influence of the painter, and subsequent restorers, alterers and manipulators, the creative process had been reduced to a single discrete act. The sculptor became an artist communicating through the medium of sculpture, and the statue ceased to be something explicitly socially constructed and defined through its engagement with viewers and modifiers. Rather than being a socially active object the statue became a piece of art with all of the prescribed modes of interpretation and engagement implied.

Contemporary attitudes towards classical statuary demonstrate the extent to which the role and nature of statuary has relied on the social world to define the conditions of its existence. As statues had roles and were active conveyors of meaning in the Roman world, equally they were ascribed a different function in modernity. However, it is the Roman world that we wish to study and we need to adopt positions in relation to the objects which interest us to take account of this. This realisation is outlined by Gordon in his 1979 article *The Real and the Imaginary*. He speaks out against the “fictitious problems” of formalist Classical Art History, as defined by Bandinelli, but goes on to reject the Marxist approach which Bandinelli proposed as a solution (Gordon 1979:6). The conclusion arrived at by Gordon is that we must abandon positivist attempts at reaching truth and objective classification and instead engage with the social worlds within which these objects were created.

If we are to move beyond modes of understanding and analyses which have their roots in inflexible formalism and essentially abstract modes of structuring knowledge of statuary then we need to propose alternative means of interrogating the available evidence. This process must begin with attempts to re-contextualise the object and to begin to think about statues not as containers of meaning but as records of intentionality. Hopkins (1985), Stewart (2003) and Revell (2009) have all conducted socially focussed studies of different aspects of Roman society which seek to incorporate and to account for the social role of statuary. A striking example of this approach can be found in Price’s (1984) account of the role of the image of the emperor and the significance of objects bearing his likeness in the reinforcing of the Imperial cult.

Sculptural polychromy

To the popular gaze colourful painted statues are compelling and, as many authors have noted, they seem to imply an imitation of life that white marble statues do not (Owen 2006; Bonn-Muller 2008). Often these reactions can be seen not to have been to the presence of colour but

rather to the absence of monochrome marble. It is the difference which is startling and not the nature of that difference. The power of polychromy to engender an apparent vitality in statues seems not only to be a feature of the contemporary world. Indeed, Stewart (2003) gives a detailed account of this process in relation to wall paintings in his discussion of the image of Mars in the House of the Venus Marina at Pompeii. The colouration and situation of the subject here clearly suggests a marble statue on a pedestal; yet the subject leans to the left, much further than would be possible for a statue, displaying the absence of any strut or support, and crucially, has defined eyes, differing little in style to a depiction of a person rather than a statue. (Stewart 2003: 40). Such work explores the relationship between statue and life. Furthermore, unlike the wall painting, what underlies the painted surface of a statue is a highly refined representation in itself. Rather than considering the paint as the medium which enlivens the inanimate statue we must think of the statue as a representative whole.

Clearly colour is more ephemeral, more subject to decay than marble, and as such polychromy implies transience. Whilst the underlying stone remains static the surface may change and alter over time, and with it the meaning and social function of the object. Bradley (2009) observes this process of change taking place on the statue of Augustus from Prima Porta where the statue was probably repainted using different colours and certainly restored and altered over time. Bradley describes the Emperor's representation as "organic, subjective and interactive" (Bradley 2009: 450).

Sculptural polychromy does not merely denote the application of paint to stone. The colour of any object is defined in part by the materials chosen, and also the way in which it is constructed, the light which renders it visible, and the space which it inhabits. Therefore the appearance of the statue will be defined as much by light and the colours and forms around it as by its own composition. As such, any meaningful consideration of colour must consider both the object itself and the structures of space and light within which it might be situated.

A statue's colour is determined in the first instance by the perceived colour of the marble. To describe many marbles as monochrome ignores the richness of colour and the depth, texture and complexity of their finished surfaces. The complex surface properties of marbles mean that, when treated in different ways, they are capable of producing a vast range of visual effects. These include the high shine of a polished *Pavonazzo* and the depth of *Parian* marble, which can be so translucent as to appear to be lit from within. Amongst the physical factors which influence these effects are the nature of the inclusions, the grain size, the orientation of the crystals, the purity of the calcite and the degree of crystal stress and twinning. Each of these variables will dictate the appearance of a marble and the way in which light behaves upon contact.

This richness of tonality and colour renders the monochrome/polychrome dichotomy rather ambiguous. Statuary which was never artificially coloured but which makes use of natural tone is a very different proposition to statuary which has been consciously altered in order to conform to a modern monochrome aesthetic. It is evident that marbles were selected, at least in part, due to their surface properties (Bartman 1991: 73; Rockwell 1993). We are able to see the selective process through the range of marbles utilised for different purposes, often within the same statue (Elsner 1998; Kousser 2008: 1). There are many similarities between the sub-surface interactions of light and human skin and the interactions between light and certain kinds of marble. We may consider that this physical similarity, and its visual correlate, suggests an understanding not only of the desirability and quality of materials but also of the visual effects which could be achieved through their use and manipulation. In turn, this informs discussions of realism and the ambiguous relationship between sculptural realism and life; a

theme of modern scholarly writing and of the Roman world (Elsner 2007: 116; Stewart 2003: 262; Wheeler 1999: 155).

Perceived Greek and Roman attitudes towards marble have shaped discussions of the extent to which marble might have been supplemented through the addition of further colouration. The value of marble as a commodity within the Roman economic sphere is well documented (Oleson 2008; Peacock 1988). It is not clear whether the aesthetic and commensurate monetary value placed upon marble would have precluded it from being painted, or indeed whether the addition of pigment to a marble surface could have been seen to diminish its natural appearance. Such a position would presuppose that the addition of colour was peripheral to the identity or role of the pristine sculpture. The first and most obvious example of additive colouration applied to the marble surface is the pigment, composed from a range of materials of differing value and significance and embodying differing levels of meaning (Brinkmann 2004). It has been suggested that a visual language is evident in the use of colour applied to statuary (Holscher 2004; Bradley 2009). We must also consider the messages which would have been implicit in the use of particular colours in specific contexts to viewers of different sorts (Pollini 1995; Wallace-Hadrill 1994: 166). Both the pigment layer and undecorated marble may, in turn, have had a further layer of surface treatment. One form of this was *Ganosis* described by Pliny as a mixture of wax and oil added to the surface (Bradley 2009: 438). It functioned both as a protective layer and as a colour enhancer, considerably altering the tone of both pigment and marble. Another was *Atramentum* a brown varnish which is thought to have enhanced and softened underlying colour (Brachert 1994; Bradley 2009: 438).

Other methods of additive colour to be considered are the use of physical adornments of various kinds and the use of surface finishes. Adornments such as staffs, weapons or jewellery rarely survive but surface indentations and holes suggest these to have been commonplace. These might have been composed of a range of materials but are likely to have included the use of metal. Furthermore, there is some evidence for the draping of statues in textiles in Roman literary sources (e.g. *Eclogues* 7; *Metamorphosis* 10). There can be little doubt that, as well as acting as symbolic notations, such additions were also employed as visual devices drawing attention to or augmenting the statue's stylised realism. They permeate the physical boundary between statue and space and between real and unreal, whilst further adding to the statue's texture and colour (Pollini 1995: 263; Østergaard 2008; Hanfmann 1964).

Digital polychromy

The use of digital techniques loosely described as computer-generated imagery (CGI) is perfectly suited to the visualisation of statuary in context (Barceló 2000; Martinez *et al.* 2005). Computer-based reconstruction of cultural heritage – sometimes anomalously referred to as ‘virtual archaeology’ – is a tool that is highly suited to the meaningful representation, reconciliation and re-contextualisation of disparate data sets. Such technologies have also found applications in the interpretation of Roman archaeological data sets (Haselberger and Humphrey 2004; Earl 2007). This has not been without concerns; primarily the potential of apparently ‘photorealistic’ digital imagery to be viewed as an accurate recreation of the past, solely on the basis of its visual fidelity. Such concerns are discussed in the archaeological computer graphics literature and it is our belief that awareness of the origin of a particular image, coupled with the same forms of representative critiques levelled at other visual archaeological media such as photography and illustration, is sufficient. Of more interest is the

potential for the computer to go beyond the appearance of visual accuracy and to employ digital methods that are themselves physically based.

The development of demonstrably accurate computer-based lighting models and simulated physical surface properties adds a new dimension to visualisation and the interpretation of images. Recent innovations in computer science mean that, for the first time, archaeological applications of CGI are able to incorporate a degree of physicality into what remains a creative process. Prior to this development, the production of hand-drawn or computer reconstructions was almost an entirely interpretive act. The inclusion of demonstrably accurate elements such as lighting models, surface properties and geometry, mean that visualisations can go beyond a merely illustrative role and can begin to function as virtual research environments. Thus, archaeological CGI becomes a process whereby interpretations are structured around an accurate representation of the available data. Because the results of such simulations are tied to physical laws they are quantitatively comparable to real-world visual perception (Happa *et al. in press*).

For the first time it becomes possible to ask questions which assume a degree of accuracy related to the behaviours of light and objects in the real world. These may be simple and abstract: for example “how would a certain paint appear in light of this type, when applied to a particular marble?” They may also be more complex: “how does the changing light caused by weather conditions effect the appearance of the statue, assuming that it was painted using a particular pigment and placed next to a wall painted with another pigment?” The images produced using these methods are not demonstrating all aspects of how a statue looked but are simply allowing the formulation of complex, contemporary, visual research questions. They incorporate the exploratory elements mentioned above, whilst introducing structural and accountable content. At the same time these representations are decidedly modern and we do not argue that by merely visualising something redolent of a Roman scene we are able better to understand how it would be observed by the Roman viewer (Elsner 2007). Rather than acting as a method for viewing the past, such scenes are a reformulation of existing data into a format which allows different questions to be addressed.

The fundamental and most crucial element of any visual scene is light. Its presence or absence not only dictates visibility but how light behaves dictates how an object appears. In order for the production of visual archaeological simulations to be considered valid it is imperative that the lighting model is accurate. By using a lighting model of this type it is possible to accurately simulate Roman sources of light, such as oil lamps, in addition to the sunlight present at a particular place, or time and date. Such lighting models can also incorporate the effects of weather conditions and particles in the air (Sundstedt *et al.* 2005, Gutierrez *et al.* 2008).

In order for the process of physically accurate modelling to be effective it is necessary to understand the different components of the scene which will affect the behaviour of light. These include, but are not limited to, the geometric form of the statue, the type and finish of marble used, the pigments and surface treatments applied, associated objects and draperies, and the context within which the statue was placed. In the case of the Herculaneum Amazon we are gathering a range of correlating data from surviving heads of the same type, better preserved in terms of form but largely lacking surviving polychromy. The surface properties of the Amazon head and similar materials are also being studied in order to better understand the way in which light is scattered across and within the surface of the marble. Digital records of these correlates enable the construction of a geometric amalgam, incorporating a digital simulation of its surface and sub-surface physical structure, over which a digital replica of the pigment may be

built up and augmented. Such digital repainting is a complex process, particularly as pigments may be semi-translucent, applied with varying thicknesses and textures. Replicating the physical structure of the marble is similarly complex, with the digital simulation requiring the surface to absorb, reflect and refract light in a range of ways.

In addition, the transport of light between objects in a given scene has a dramatic impact on the appearance of all components. The virtual world provides an opportunity to experiment with context. Thus, for the Herculaneum Amazon we are constructing models of the Basilica Noniana which may have contained the statue. But the uncertainty regarding this context – the location of the statue, the architectural components, wall paintings, other statues, luminaires and so on – require a careful comparison of possibilities. It also requires an emphasis on the analysis of archaeological space as an explicitly creative practice, focussed on possibilities for interpretation rather than on impediments.

Conclusions

The possibilities of digital simulation of painted statues remain under-explored and our own project is still in its earliest stages. In addition to the technological challenges of physically accurate digital simulation of marble, pigment, surface treatment and adornment, the use of such digital simulacra remains under-theorised. However, the flexibility of interpretative practices afforded by physically accurate simulations will offer valuable new areas of research. The distinctions between physical experience and digital representation are narrowing and the role of archaeological theory will be of crucial significance. Whilst we do not yet understand fully what it is to create and to think within a wholly digital, but realistic Roman archaeological world, we look forward to the new engagements with the past that such practices will engender. As the analysis of surviving sculptural polychromy continues we may begin to see the colours and textures of the Roman world in a new light, with computation lending new eyes and new contexts for interpretation.

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