Institutionalised Invisibility:
Histories of Models and their Makers

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Declaration

I, Jane Elizabeth Insley, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

My thesis combines interdisciplinary research methods and is situated within the field of museum collecting: specifically it investigates the histories of models commissioned and used institutionally for instructional display. Investigating three collections (crystal models in National Museums Scotland, Edinburgh; architectural models at St Paul’s Cathedral, London; and dioramas at the Science Museum, London) I found evidence of official and unofficial forgetting. Once high profile, models were removed from public display and are in danger of disappearing altogether. Further, I investigate the fate and reputations of the models’ makers, uncovering their training, careers and how they were valued, revealing previously unrecognised stories that could contribute to institutional history, and to the development of wider audiences.

I consider what others have thought about the practice of history focusing on object agency, authenticity, copies, memory, and the role of museums, using Actor-Network Theory. Literature from the fields within which the models were (originally) created is considered alongside the collection histories. The models are representational, and used as tools – crystal models for understanding and teaching properties of matter, architectural models for analysing and creating buildings, and dioramas showing context for scientific and technological processes. Despite having essential skills the makers became side-lined.

I discuss how this invisibility occurs by considering institutional attitudes to their own histories in present practice, and the nature of official forgetting through disposal. Choosing what should be remembered and how is the subject of a museum sector shift, contemporary concern being for more open, reflective collection management and audience engagement, and maximising use of items which are preserved. I finish with contemporary examples of public enthusiasm for these subjects in craft, art history and exhibition – visibility regained.
Impact Statement

Cultural institutions sometimes ignore the histories of the collections in their care to the detriment of the uses to which they may be put. Radical transparency in museum practice and hierarchies of control of national histories is of growing concern at international levels. I present multi-disciplinary research in the histories of science and technology, architecture, education, and museum institutions through three collection studies illuminating aspects of material culture practice, and how these sometimes fail. I used Actor-Network Theory to privilege both objects and under-appreciated characters in the histories of 3D models, which after their first active lives now face uncertain futures.

During my research I have clarified identities of models and makers in collections of crystal models in National Museums Scotland, Edinburgh, architectural models at St Paul’s Cathedral, London, and dioramas at the Science Museum, London. I retrieved forgotten history, challenged institutional hegemonies, added to cultural capital and potentially enhanced the heritage worth of these items to their owners, perhaps helping to secure their future survival. Their custodians now know more about them; the institutions can therefore develop more informed policies for care, use, retention and disposal, increasing radical transparency in the wider museum sector. Moreover, my results are available for future access to a wider range of interested audiences via catalogues, websites, exhibitions and other media.

For the crystal models, their physical storage is greatly enhanced; several thousand individual items have known locations, been assessed for conservation needs in a parallel project inspired by my work, and some redisplayed. I received grant support from the international Scientific Instrument Society, and published in their Bulletin. I discovered details of the range of and enthusiasm for self-help and improvement in crystallography in the 19th century, again receiving grant support from the international History of Education Society, speaking at their annual conference and being published subsequently.

The Deutsches Museum, Germany, included my survey of Science Museum dioramas in their own celebration of similar models; my first lecture on architectural model making history was at an international conference attended by architects doing history, and art historians studying architecture. Reviewing the histories of learning to draw and of manual training showed these practical skills were much more widespread than appears from official historical records (an issue found elsewhere - at a recent meeting of heritage engineers, a similar insight arose with respect to the producers of industrial
plant). Investigating institutional practice showed pathways for memory and forgetting, and has helped bring more transparency to selection and disposal.

The role of non-digital 3D models in many fields of study is becoming more apparent, acknowledged, and recognised. The popularity of modelled scenes, for set design, military history, industrial processes, urban planning, children's pedagogy, and indeed in forms of 3D art, shows that non-academic interest in 3D model making continues. I suggest the models and makers I have studied can and should be better remembered.

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Abbreviations

2D two-dimensional
3D three-dimensional
AHRC Arts and Humanities Research Council
ANT Actor-Network Theory
CIMUSET International Committee for Museums and Collections of Science and Technology (one of 26 international committees of the International Council of Museums)
DNB Dictionary of National Biography
DSIR Department of Science and Industrial Research
EAHN European Architectural History Network
fn footnote
ICOM International Commission of Museums
Inv no Inventory Number (ScM)
LMA London Metropolitan Archives
NAL National Art Library (at the V&A)
NMS National Museums Scotland, Edinburgh
NMDC National Museums Directors Conference
para paragraph
POLD Post Office London Directory
RCA Royal College of Art, London
RIBA Royal Institute of British Architects
RSA Royal Society for the Encouragement of Arts, Manufactures and Commerce, London
RSE Royal Society of Edinburgh
ScM Science Museum, London
S-CMB Sub-Committee Minute Book [St Paul’s Cathedral]
SPC St Paul’s Cathedral, London
SPCAA St Paul’s Cathedral Architectural Archive
STS Science and Technology Studies
V&A Victoria and Albert Museum, London
U3A University of the Third Age
UCL University College London
USA United States of America

References

References within the text follow a Harvard style (eg. author, year:page numbers) or (year:page numbers) where this is unambiguous. For readability, archive references are cited in footnotes; references within the thesis have the form (thesis:page numbers).
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1 Introduction, research questions, theory, methodology

1.1 Introduction

There is something quite compelling about models. They originate from a variety of sources, for a variety of reasons, are used in a variety of ways, and often end in situations remote from the initial purposes of their creators. Before retirement in 2012, I was Senior Curator, Engineering Technologies, at the Science Museum (ScM), London, responsible for collections including models. Researching the history of the museum’s dioramas tided me over the work-retirement boundary. I then became involved with two other collections, crystal-shape models at National Museums Scotland (NMS) in Edinburgh, and architectural models at St Paul’s Cathedral (SPC), London. All three collections were no longer in active use, but stored out of public view in institutionalised invisibility, effectively forgotten. As a former museum curator, I knew most museums have quantities of material not on show, reserve collections extending or backing up displays, or held in deeper storage. The museum’s unique selling point is the museum object, chosen for preservation, future study and/or exhibition. In national museums such as the ones where I worked, collection items are selected for the nation’s benefit, made and kept available as far as possible through nationally accepted procedures. Accurate and informative object records are crucial, covering legal transfer of ownership to the institution, their former history, why the institution wanted and accepted them, and, once in the museum, where they are and how they are used. I also knew there is more material in care than any individual can be expert in; records made by previous staff are vital, particularly where the institution’s history is longer than a single individual’s career and staff numbers are low. A good memory is a useful asset for a curator, but insufficient on its own. Equally, records can be incomplete; historical work on existing collections establishes past relevance, and informs fresh approaches.

For example, the last exhibition I worked on before retirement was a redisplay of the steam pioneer James Watt’s garret workshop. The workshop had been in the Science Museum since 1926, and re-erected (including furniture and fittings from the original house) in several places around the museum. Our display set the workshop in a more prominent position in the museum, and we carried out a more complete investigation of the contents than had been previously possible. This gave a glimpse into the passions, preoccupations and souvenirs of a hugely significant engineer, which at the time, the late 18th century, were extremely wide. Watt’s steam improvements originated from his attempts to make a model engine work properly. He used models himself to formulate

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1 In this document, a 3D model made using primarily manual techniques.
his ideas, starting what is sometimes called the Industrial Revolution; the results changed the world. The museum holds many models of technical and scientific importance, few with the significance of the Watt models, but underestimated if their stories are unknown. Before I retired, the Collections Management teams clearing galleries assessed objects against criteria of significance for factors ranging from historical association to physical condition. The results, entered on the database, inform decisions about future potential use and storage. But value judgements vary, over time, context, and who is making them; gallery clearances facilitate such (re)appraisal of items for retention or disposal.

One particularly useful piece of information about any museum object is the maker’s name. It gives a starting point for finding out when and where the object was made, and potentially links it to other works by the same person. It also links attention between the inanimate object and the people and stories behind how the object came to be and why. At work, I was familiar with ignorance about makers, but, with much else to do work-wise, the absence of maker information did not strike me with the force it has during this study. Towards the end of my museum career, I led a collections rationalisation project, reviewing stored items at the Science Museum’s airfield site near Swindon against the disposal criteria in the National Heritage Act 1983, and presenting the resulting arguments to a committee of senior colleagues. The project cleared about a quarter of an aircraft hangar (objects were disposed of, but their stories retained), and left me with a sense of disposal as official forgetting. It was only taking a wider view across the three model collections that I realised the extent to which model makers were unconsidered. Context reading in history of the art/craft distinction suggested that makers were ignored because they were makers; unpicking why this might be challenged me to confront different, earlier value judgements revealed by the collection stories, and my ability to absorb, accept, understand or question a modernist paradigm valuing creativity over manual skill.

Lacking manual skill myself, I was in awe of the model makers’ abilities, and surprised by institutional ignorance of their identities. I had been unaware of the intensity of attitudes to the dichotomy between artist and craftsman. Considering the makers as artists, my standpoint was at odds with modernist ideas of de-skilling art to release creativity; considering them as craftspeople, post-modern attitudes and recent research was more positive. The three collections spanned the range; crystal model makers were generally technicians, diorama makers often trained as and called themselves artists, and architectural model makers were in ill-defined middle ground between the two. Restricting my study to professional modelmaking (hobby 3D modelling being separate
but immensely popular, an informal reservoir of haptic skills), it occurred to me something interesting might emerge from considering the three model types together. Could or should the makers' and models' visibilities be regained?

All three model types were representational, offering versions of reality, usually at a different scale from life-size, for explanation to students, to visitors, to engineers. Initial institutional interest must have been high. The models were commissioned, acquired or accepted, purposefully, their monetary value to their owners seen in prices paid, and their cultural value in their use to achieve intended aims. That the models were created in the first place showed institutional appreciation; they fell out of use through internal institutional mechanisms, reflecting changing priorities and practices. Interest in their histories fluctuated over time; why?

All three model types have attracted fairly recent but not extensive academic interest; I shall consider their literatures alongside the collection stories, but one relatively recent commentary from the history of science stands out. Soraya de Chadarevian and Nick Hopwood edited a thought-provoking survey of scientific models (2004:1-15), introducing it by commenting 'Historians and philosophers of science have long been interested in models and other representations, but focusing on the production and uses of 3D models challenges received views.' Models had been used to explicate what theories were and how they worked, mediating between theories and phenomena, but major classes of models tended to be side-lined. Studies of representation in scientific practice focused on the use of tools and instruments to produce engravings, traces, print-outs, and other standard representations to be manipulated and displayed, scientists seeming to discipline nature most effectively by reducing three dimensions to two (ibid.:2). As the editors remarked, this is as incomplete as a history of art without sculpture. (Scientific) models survive in museums and universities by more fortuitous routes than, say, those of books in libraries, and are more typically studied from the perspective of pedagogy or popularization. (Arguably, this was where I started, with museum collections aimed for public benefit). The editors suggested that slighting models because of this viewpoint was a mistake (so implying it did happen), teaching being centrally important in ratifying and conveying knowledge, and addressing wider audiences crucial to establishing scientific authority.

Their survey included contributions on both chemical models and natural history dioramas. Christoph Meinel (2004) discussed 3D models of chemical molecules, visualising how Fröbel's kindergarten ‘Gifts’ of the 1840s influenced organic chemists of the 1850s. I have suggested (Insley, 2015a), from similarities of illustration, that Fröbel
himself may have been inspired in making his Gifts whilst working for the crystallographer Christian Weiss, in Berlin in the 1820s. Crystal models contributed to scientific education, embodying research and sharing it, but their histories were largely ignored. The models’ survival shows a truly impressive potential utility of well over a century, despite their being packed away by the time I noticed them. Lynn Nyhart (2004) discussed natural history dioramas - full-scale, realistic representations of once-living creatures, claiming authenticity from their former animated existence. She argued displaying groups of specimens could be regarded as science, contrasting different approaches in Hamburg and Berlin (one overt, one implicit). Issues of authenticity and openness of intent behind display are directly relevant to my thesis, although in contrast, the Science Museum's dioramas were intended to illustrate context, being mostly fully modelled, not (necessarily) to scale, and rarely including unmodelled components. Furthermore, it is little-acknowledged that dioramas depicting human activity have a quite different history from habitat ones.

For literatures relating to the multiple aspects of this research, further detailed in section 1.2, I chose to follow senior academics, and key workers in nationally important museums. Philip Gardner, senior lecturer in education, University of Cambridge, reflected on history’s disciplinary processes, urging attention to theory as a way of widening potential sources of material. Extending this to objects as opposed to documents, Ludmilla Jordanova, Professor of Modern History, King’s College London and a trustee of the Science Museum, discussed using objects in historical studies, an example of the non-human turn privileging objects as well as humans. Richard Grusin, Professor of English and Director of a Centre for 21st Century Studies, surveyed a number of such approaches, several influenced by the French sociologist Bruno Latour’s Actor-Network Theory, ascribing agency to both objects and humans. Neither Jordanova nor I take the idea of object agency as far as Latour does, but fresh cultural takes such as my research here can arise from their study.

Bill Brown, Professor in American Culture, University of Chicago, devoted a journal issue to thing theory. Archaeologist Arjun Appadurai related objects to their context and function, what they do rather than what they are, important for the ideas that they project; this resonates with the models here, all high quality copies of otherwise unavailable originals, and primarily intended for display and education. But the status of the copy in art history is complex, used for facilitating homage to admired items from elsewhere, or mimicking more cheaply an original artwork to widen access to it. Walter Benjamin’s ideas about mechanical reproduction (widening audiences, but losing authenticity of originals) were hugely influential. Lecoq de Boisbaudran’s discussion of
the role of art in memory and education pulled together three aspects of my study: he taught many famous French artists, including Rodin, subject of a recent exhibition at the British Museum.

Frances Yates’ seminal work in memory studies, Charlotte Linde’s ideas on working the past and Paul Connerton’s study on how societies remember informed the section on institutional memory. Relating artefacts to collective and craft memory practices led me to a number of commentators listed here but discussed in more detail at the appropriate sections; history of art, (Shiner, Mansfield – attitudes to art), craft and workmanship (Adamson, Pye, Harrod, Dormer – attitudes to craft), and museum practitioners looking after artefacts for public benefit (Mack, Dudley, Marcus – collection custodians).

I describe below how the three model types came to my attention. Considering features shared by these rather disparate collections led me to my research questions, subject to certain research limits and boundaries. In further chapters I outline each of the collection types and their literatures, an independent study of model making businesses attempting to illuminate the craftsman/artist distinction, and the institutions’ practices of memory and disposal. I conclude by reconsidering my findings, answers for my research questions, the utility of the literatures and ANT, the impact I have made as a result, and whether similar issues of invisibility occur elsewhere in the subject areas to which my study collections might be assigned. I finish with recent examples of present practice where models have been demonstrably appreciated.

**First contact: Dioramas**

Impetus to research Science Museum dioramas came from a public enquiry about a scene showing ploughing with oxen, based on an illustrated 14th century psalter. Public enquiries at the Museum often related to items about which the curator might know little. Subject areas were represented by named collections of items, developed by purchase, gift, transfer and bequest. Curators might be subject specialists for (some of) the collections in their care, expected to assimilate details of other museum holdings and present them to a range of audiences. Commonly, detailed examination occurs for database descriptions on acquisition, as part of catch-up projects surveying stored collections, when clearing a gallery for a new exhibition, or, as here, answering public enquiries.

The maker was Raphael Roussel, diorama supplier to the museum from 1931, the enquirer his niece, visiting from Australia. The diorama was signed, and dated 1951 (Plate 1). The label gave the date of acquisition and the source, the British Council.
Plate 1.

1. Diorama, *Mediaeval Ploughing*, R Roussel [ScM]

2. Location in Agriculture Gallery (until 2017)
Finding information about museum objects involves consulting acquisition information, related documents or photographs, checking others of a similar kind or from the same source, and following resulting leads. Much, but not all, of the correspondence between Roussel and the museum was preserved. He worked on several subject areas and collections, and was not the only supplier. The museum had about 150 dioramas at various times (two thirds still surviving) but never devoted a dedicated publication to them. As Roussel’s story unfolded, a call through the H-Net academic bulletin board requested suggestions for a natural habitat diorama bibliography. One was Karen Wonders’ Habitat Dioramas (1992), in which she compared attitudes to wilderness through approaches to taxidermy and display settings for ex-live specimens, using primary archive material. I was impressed by her work, but uneasy with some of what she had written, a feeling only resolved on rereading the first part of the book, where she said:

Attempts to recreate the human form fail to arouse the trompe l’oeil effect that is the aim of the habitat diorama. No matter how realistic a human model may be, there is always an intuitive sense of its falseness … that prevents a real illusion from occurring in the mind of the viewer (1993:17).

This unsubstantiated statement turned my enquiry-answering into a mission. I felt strongly dioramas showing human activity were no more false and every bit as capable of inspiring interest and curiosity as ones showing ex-live animals. I followed up stories of the Science Museum dioramas and their makers, only later realising issues faced in unearthing them might also be worth studying (Insley, 2006; 2007a; 2007b and 2008).

First contact: Crystal Models

The last exhibition I worked on in the 2010s before retirement concerned the Scottish engineer James Watt (1736-1819) and the beginnings of the Industrial Revolution (James Watt and Our World, 2011) using as centerpiece the re-erected garret workshop from his home near Birmingham, built in the 1790s and transferred to the Science Museum in 1926.

The contents listed in the 1880s by Mr Collins, the Watt family’s local agent, mentioned an inconspicuous box (Plate 2), containing 216 boxwood prisms. In fact these were models of crystal shapes, carved probably by hand, but when? Where? And why? A volunteer working with me, Valerie McCathern, was an enthusiastic craftswoman, and I showed her round the workshop. When I opened the box, her reaction was visceral. I

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2 ScM Nominal File 5406 R T Roussel.
3 Preliminary work for Rader and Cain (2014).
Plate 2

1. The Watt crystal models [ScM]

2. Valerie matching models to plates

3. Selection of crystal models at NMS,

4. Granton store, NMS, before move
was instantly pleaded with to allow her to scan each little model, while I tried to identify them. Again, enthusiasm of an onlooker provided impetus to discover more.

She produced a definitive list, grunt work I did not have time to do. The models had several distinctive marking systems; I looked for an illustrated mineralogy text, familiar to the Watts, with similar numbering. Searching finding aids to Watt material in Birmingham City Archive, and knowing likely dates, I found matching texts. James Watt Junior, not Senior, owned the models (Insley, 2011).

I visited the National Museums Scotland (NMS) in Edinburgh to see Roussel dioramas made for their Egyptology Gallery, and in a storeroom belonging to the Natural Sciences Department noticed roller racking marked ‘Xtl models’. This contained forty drawers of largely unsorted crystal models, including some clearly like Watt’s ones. I volunteered to sort them out; the collection curators agreed, as I was experienced and unpaid. The stores were about to transfer to a new building, so sorting was timely – if you have chaos, it remains chaos when you move it. Finding identities for this much larger collection would be less straightforward than it had been for Watt’s models.

**First contact: Architectural Models**

The Science Museum passed me an enquiry concerning unidentified surveying equipment from St Paul’s Cathedral, shortly after I retired. I had relevant experience and live locally so this was a dream opportunity to see previously unknown material. The equipment was used in the 1920s to measure the fabric of the building, investigating the likelihood of collapse (Insley, 2016a; Saving St Paul’s, 2019). Their studies included creating two very fine architectural models of parts of the structure, known internally by the name of the Surveyor of the Fabric, the architect responsible for overall maintenance of the building. The architect had not actually made the models. But who had?

Once again, I searched through the collections. Handling large and fragile models is impossible without help from permanent staff. However, following my work on the surveying equipment and with institutional backing for this thesis in the offing, I was allowed external researcher access to archives and records, and will share my discoveries.

As a preliminary, I decided to investigate architectural modelers in London *ab initio* from trade directories. I give the names, dates and addresses of people describing
themselves as architectural model makers in the Appendix. Chapter 3 discusses other factors contributing to the comparative invisibility of makers of all forms of model.

The Cathedral architectural models are in secure but not ideal storage (Plate 3). They are not numerous, but some are very important in architectural history. I have been unable to examine individual models as closely as those in the other two collections. However, archive searches in the Cathedral, in the London Metropolitan Archives (LMA), and in the various libraries of the Royal Institute of British Architects (RIBA), have revealed more of their hidden histories. Yet again, finding the makers of the models was more difficult than I anticipated; it may never be complete.

Why take these three collections of models together?

These concurrent but independent projects all involved models; were there any commonalities, beyond my own interest? Might they inform insights about model making in general? The models are representational, produced in attempts to make sense.

Crystal models illuminate a period when chemistry, crystallography and mineralogy were emerging as disciplines from natural philosophy. Architectural models helped clarify load-bearing stress in an ancient iconic building. Dioramas widened appeal to Science Museum visitors lacking technical knowledge. The three forms of model objectified ideas about the past, present and future. The Science Museum dioramas represented ideas about the past. At National Museums Scotland, crystal models helped make sense of mineral specimens to contemporaneous observers. Structure models informed future preservation work for St Paul's Cathedral.

The models were held in institutions – two national museums and a cathedral – where an interest or sensitivity to the past might be expected. But another common factor was the absence of institutional memory about the models and their stories. Obvious initial questions were – what are these objects, who made them, why, for whom, and what happened afterwards? As I discuss in Chapter 4, these institutions are sites of official memory, so there were deeper issues to do with the politics behind the use of models, their real or apparent physical appeal, why they fell in or out of fashion. Can they have future purpose in an increasingly digital world?

Recovering official memory may shed light on selection of memories. Selectivity may result from the model's role in the project of which it forms a component – for instance, the main purpose of a cathedral is worship and pastoral care, not preservation of architectural models. Memory is both selective and selected (thesis:28). Deciding what
Plate 3

Model aisle, St Paul's Cathedral, London
to remember is a conscious act; our view of the past depends on our current vision. The lack of interest in models’ provenance was sometimes reinforced by official forgetting. The object stories include origination, manufacture and use, and also when they disappear from public prominence. Forgetting can be informal (through mistakes, carelessness, ignorance, indifference), or formal (internal, institutional, professional or governmental). Makers or suppliers of models were obviously known at commissioning and delivery; later, they were variously ignored, regarded as irrelevant, forgotten, or otherwise rendered invisible. Why?

Uncovering hidden attitudes and procedures shows what institutions value (the famous, rich, high status, people/men, as opposed to the poor, every-day, utilitarian or commonplace). However, with globalisation, craft skill is increasingly appreciated. For example, the Cast Courts (2018) at the Victoria and Albert Museum (V&A) were expensively redisplayed in 2014 and 2018, celebrating the ‘authentic copy’. Why not these models?

Why now? Models are in danger of disappearing from our official memory institutions. Reasons for having them fade over time. Design, fashion, technology, scientific ideas all change. Bulky and fragile models present institutional problems of preservation and sometimes compelling arguments for disposal. Small but numerous crystal models are no longer used to teach science. But enthusiasm remains for hobby modelling.

I suggest another common factor is that the model's construction was not an end in itself. All three types were part of something bigger – a building project, an exhibition, a method of teaching new science. That the models existed was more significant during their first active lives than how they originated, however appreciative the originator had been. Other possibilities followed – differences in status, education, class, and income between client and maker, on-going involvement with a model during its first active life, how individual players in the making of models saw themselves, each other, and if and how they were seen by clients and audiences.

I aimed to retrieve forgotten narratives through almost forensic reconstruction of the ‘lives’, active or otherwise, of models still extant, finding and re-considering evidence for invisible presences of models long gone, models in danger, and for better understanding of models preserved.

The models were produced during times of transition - between hand and machine craft, visualisation of external and internal features of crystals, the development of new scientific ideas and new materials. Preliminary work suggested model use depends in
part on people being able and available to make them. How anyone, at any time and of any age, discovered the skills and inclination to make a living by modelmaking might be revealed through the history of manual training.

**Research Questions**

I consider three collections of models, accumulated by respected institutions of official memory, but with conspicuously incomplete background information available to inform the models’ futures.

- What factors affect the visibility of the models and their histories?
- What factors affect the visibility of the makers and their histories?
- What factors affect institutional processes of remembering and forgetting?

Each of these Questions can be divided into subsidiary questions.

First, what models are there? What records are there (and where)? What literatures are there about model histories, and what contribution do they offer? When have the models been most visible? And which factors have been the most significant? Are models seen as real or authentic? Second, who were the makers? What records are there, and where? How did they become makers – what might their training have been, and their businesses have been like? How did they see themselves and how were they seen by others? When have the makers been most visible? Were they regarded as craftspeople or artists? Third, how did the owner institutions use their own histories in normal practice (remember themselves)? How does official forgetting take place? And how does unofficial forgetting take place?

I conclude by considering potential impacts of rendering the models and their makers invisible.

**Research methods, limits and boundaries**

I used mixed methods of qualitative research applied to cultural material, groups of models in three institutions, with a case study approach (outlined by John Creswell, 2013:97-110). Part of my research identified individual items within each collection, using further in-depth data from multiple sources of information. Each case had intrinsic and instrumental aspects; I established identities of individual models, but considering the three collections together illuminated wider factors instrumental to institutional forgetting. Information sources were the collection items themselves, related records and documentation, archives in several depositories, and both contemporaneous and
present-day literatures for identity and comment. All involve a large amount of data; I indicate in the report where boundaries arise.

My museum career pre-disposed me to focusing on the models; whilst establishing their life stories and situating them within wider contexts (Chapter 2), I found the presence or absence of information suggested invisibility as a theme. In Chapter 3, I considered model makers, using post office directories, a very direct source of basic information (names, dates, addresses and self-description of businesses) alongside other information where found. I considered how they might have become model makers, how they saw themselves, and how others saw them and their work. I sought evidence for the craftsman/artist distinction, an important contributing factor to how models and makers were and are regarded. Chapter 4 considers the owner institutions and official and unofficial routes to invisibility – how institutions forget, how they use their pasts in current practice and dispose of unwanted items. Unofficial forgetting of both models and makers happens at both individual and societal levels; values, fashion and fitness for purpose change over time. Concluding, I reappraise the research questions, the impact of forgetting, the effects of my work in the owner institutions, and whether I have found answers. It would not have been possible to do this research if I had left it much later, as both collections and records vanish from immediate public gaze. It is a significant aim to make the makers better known and even celebrated, before public traces of their work completely disappear.

‘The desire to memorialise is precipitated by a fear, a threat, of cultural amnesia (Connerton, 2009/2013:27).’

On-site fieldwork began with physical inspection of the models themselves, the most obvious visible and extant evidence of the work of the makers. An obvious boundary was access, negotiated with curators, conservators and security staff, mindful of issues of health, safety and physical assistance. I used my own notes from earlier work on the Science Museum dioramas, finding dioramas by the same makers in both the Museum of London and at National Museums Scotland. For the crystal models, I matched models like-with-like and to images of directly relevant texts, crucial for identification as I am not a crystallographer. Identification is not complete, but the unnamed are now vastly fewer in number. Physical inspection for architectural models was more limited, with issues of space and staff availability.

Archival research in internal documentation varied with each institution. The dioramas had formal documentation files, records and images in photographic studio and picture library, evidence for condition and refurbishment. These records were also incomplete;
workshop and laboratory records were not necessarily retained; surviving records are managed under the terms of Public Record, Data Protection, copyright and Freedom of Information Acts of various dates. No records existed in the owner institutions about the makers’ other works. For crystal models, internal documentation included accession registers in the Natural Sciences department (also copied, but not exactly, in files at the stores) and archive material held in the NMS from its precursor institutions, none of which included detailed identification of individual models. For architectural models, records are held in the Cathedral’s Architectural Archive, and more in London Metropolitan Archives. Some were lost to bomb damage during World War II; specific information sometimes came from passing references in other committee papers. The absence of makers’ names provoked me into an allied task, to identify the architectural modelling trade in London. For all the featured institutions, permissions to use information, text or image have been obtained; one ethical issue beyond these concerned second-hand reporting of a verbal comment, which I have anonymised.

Literature research for historical subject-specific texts, in specialist libraries (NHM, RIBA), was vital. For identifying crystal models, matching image to model could be done despite my ignorance of other languages (particularly German). For public discussion of the Cathedral models, I consulted the main London resources at RIBA and the V&A. For information concerning modelmaking, a niche trade having few practitioners of uncertain status, I restricted my trade directory search to London (location of one museum and the Cathedral, and arguably likely to support numbers of such makers). I discovered directory information for many architectural model makers, a few diorama artists, and one or two crystal model suppliers. Pinning down biographical detail for named makers represented in the collections requires further research beyond my present remit, excepting a handful of individuals with fascinating and relevant stories. Details of the model makers were uncovered, recovered or discovered in passing remarks, comments and small print of introductions and back pages of texts. Secondary literature in history of science was used for crystal model makers. Newspapers, notably *The Times* (available on-line while I was still at the Science Museum), reported new dioramas as they were displayed, indicating interest from journalists, and reporting visitor numbers attending exhibitions.

Internal literature for the owner institutions showed their handling of models reflected the both application of official policies and attitudes of individuals. Institutional histories and guidebooks evidenced attitudes to the past, giving formal statements of value placed on their models. In 2003, concern about unexhibited museum collections led the Directors of UK National Museums and Galleries to issue still-current national-level advice on the
possibilities of ethical disposal; museum literature contains occasional studies of past disposal actions reconsidered in the light of recent practice.

Moving from practical concerns to theory, and considering all three types of model, I characterise my work as grassroots history (for the makers) after Raphael Samuel and Eric Hobsbawn, and consulted the work of historians on using object sources, the non-human turn and thing theory. Actor-Network Theory seemed an appropriate approach to identifying connections and relations within the models' life stories. In the field of memory studies, the owner institutions control official public memory and how museum objects are seen. Two further areas of interest emerged; the status of 'authentic' representational models as opposed to 'real' originals, and how professional model makers were seen, as craftsmen or artists, by themselves, their clients or indeed art critics and historians. Both issues required approaches from art history, considering attitudes to 'authentic' copies, skill, workmanship and authorial genius, and the position of representational art in art hierarchy.

First, I look at theory related to the multiple aspects of this study, and explain my choice of Actor-Network Theory (ANT) in studying the collections.

1.2 Theory: what others have thought

These three disparate collections of illustrative models, preserved but largely invisibly, have problematic futures. Issues relate to both non-human things (collections, the owner institutions, and values associated with objects once their first active lives as pedagogic or explicatory adjuncts are over) and to people (idea generators, makers, users/clients/customers, audiences, and institution employees who devise or implement policy). In institutional forgetting of the stories behind the models and their acquisition, identities of models and makers have been lost. Reasons for forgetting relate to either models (the things, and their problematic value), or makers (their status, education, position in society, either from family or occupation, or gender). Forgetting can be official (enshrined in institutional policies and practices), or unofficial (individual, based on social attitudes and/or human failings). I looked for guidance about practising history; about the non-human turn; about things; about copies and authenticity; about memory; and about museum objects.
About practising history

Gardner (2010:34, fn188), remarked that setting about [re]assessing the paradigmatic status of the discipline [history] had not seemed either attractive or necessary to many practitioners. He gave several examples, including a gem from Eric Hobsbawm, who making a similar observation more colourfully, invokes a striking image of the disciplinary landscape at the end of the twentieth century: ‘Theoreticians of all kinds circle round the peaceful herds of historians as they graze on the rich pastures of their primary sources or chew the cud of each other’s publications’ (1998:vii).

As an aspirant member of the peaceful herds, I appreciate the richness of the pastures offered by my case study collections; my primary sources were material objects rather than documents; evidence to help assemble some answers to the question of how and why the collections have become invisible was widely scattered.

Gardner suggested that if they did reflect on their subject, historians might find ‘some lush new shoots … to supplement a diet which… was beginning to lack a number of essential theoretical nutrients for healthy growth’. Hobsbawm, one of the better-known Marxist historians, did not disclaim his Marxist label, explaining that Marx and the fields of activity of young Marxist radicals gave him his subjects of research and inspired his writings (1998:xi). Till the late 19th century history was written by scholars mainly interested in politics, and for the glorification and occasional use of rulers. Reference to the mass of the subject population was taken for granted, whilst generally the activities of the poor did not normally threaten social order, and tended to be at local rather than national levels (1998:266-268). In 1985, Hobsbawm had asked why history from below was so recent a fashion (1998:266), only becoming relevant at times of exceptional popular mobilisation; discovering what people really thought was still problematic. As he continued, another challenge facing grassroots history was not simply to discover the past, but to try to explain it, and link it with the present (1998:284). ‘It is important to remind ourselves from time to time that we don’t know all the answers about society and that the process of discovering them is not simple’ (1998:286). The model makers in my study were skilled, paid hand workers, few in number and working in niche markets. My people interest is primarily with the makers, rather than their clients (the originators of the ideas for the models), and the difficulties I faced finding out about them. This indeed is grassroots history, largely lacking background documentation beyond that held by the owner institutions. The makers were not particularly empowered, although one or two rose above average levels of visibility, but neither were they the poorest of the poor.
In his final chapter, on identity culture anchoring itself to the past by means of myths dressed up as history, Hobsbawm noted ‘all human beings, collectivities and institutions need a past, but it is only occasionally the past uncovered by historical research’ and he quoted Ernest Renan – forgetting, even getting history wrong, is an essential factor in the history of a nation. ‘The nationalist version of their history consists of anachronism, omission, decontextualization and in extreme cases, lies. To a lesser extent this is true of all forms of identity history, old or new’ (1998:357). In considering the histories of my study institutions, I certainly recognised ‘decontextualization’ and omission, applied to both models and makers at various times. Most made objects in museums are already decontextualized, being removed from the sites of their initial purpose and first active use, and much of my research concerned identifying and filling absences in the records.

Raymond Williams defined the field of cultural sociology as concerning the social processes of all cultural production (1981/1986:30). "Culture", at its most general level … is a selection and organisation, of past and present, necessarily providing for its own kinds of continuity’ (ibid.:184). Furthermore, ‘tradition is a process of deliberate continuity … which can be shown, by analysis, to be a selection and reselection of those significant received and recovered elements of the past which represent not a necessary but a desired continuity’ (ibid.:187). Intrinsic to this is that we choose what to remember or value, here manifested in which models remain, and their related documentation.

About the non-human turn

In 2012, Jordanova considered the artefactual study of visual and material evidence by historians. Accepting the capacity of artefacts to touch people profoundly (2012:187), she was not attempting to write about theory, but about approaches, about ways of looking, thinking and writing in the discipline of history. Approaches are looser than theories, and the term is well-suited to the eclectic manner in which most historians practise. ‘Approaches’ suggests an overall orientation towards one’s subject, composed of diverse elements, including the personality and preferences of the researcher. ‘Method’ refers to something more limited and structured, a definable manner of undertaking a task. I take comparative analysis to involve both approaches and methods, and to be drawing on ideas from many disciplines, but without a single theory underlying it, merely the conviction that comparison is a powerful form of reasoning that can be used to guide thinking with the eyes (2012:229).

I found this reassuring, and similar to my previous museum-based historical work. She was not alone; the same year a conference at the Centre for 21st Century Studies at the University of Wisconsin-Milwaukee surveyed an array of artefactual approaches in
humanities and social sciences. The non-human turn is one of a number of ‘turns’
deriving from theoretical movements arguing against human exceptionalism; Grusin, the
organiser, listed them. They were loosely linked by opposing variously a number of
other late 20th century turns which were more linguistic or representational – textual,
cultural, ideological, or aesthetic – and sharing resistance to privileging the autonomous
male subject of Western liberal tradition (Grusin, 2015:x). Brian Massumi contrasted the
non-human turn (foregrounding objects) with a constructivist approach (building up
ideas from experience, commonly applied in museum work), remarking that rather than
things ‘coming to be’, what actually came into being were new social or cultural takes on
things (Grusin, 2015:xi). New cultural takes on the models studied here may help
ensure their survival. Aiming to overturn privileging of the human, object-oriented
ontology, a term coined by Graham Harman in 1999, was based on Martin Heidegger’s
work (‘object-oriented ontology’, 2017) and could be seen as part of speculative realism
(itsel a term coined at a conference at Goldsmith’s College in 2007, Harman being a
main contributor), (‘speculative realism’, 2017). Grusin commented on the increasing
and technologically-enabled (and therefore non-human) speed of mediation of academic
discourse, and his own non-human turn encouraging critical attention to discourses of

Two major influences for Grusin’s contributors had been Donna Haraway’s *Manifesto for
Cyborgs* (1985) and Bruno Latour’s *Science in Action* (1987), from critical STS (science
and technology studies). Haraway’s concept was not useful for me, but Latour’s was.
His Actor-Network Theory (ANT) was a career-long project from the early 1980s,
developed with Michel Callon and John Law to articulate technical mediation, non-
human agency, and the politics of things. He distinguished between intermediaries and
mediators, mediators not being neutral means of transmission but actively involved in
transforming what they mediate (Grusin, 2015:xvi). Grusin suggested a ‘turn’ could thus
be seen as a means of translation or mediation in the Latourian sense (2015:xx). Of his
nine contributors, three mentioned Latour’s work, influence or ideas.

Grusin also noted trauma theory used to challenge the idea of affect as non-human, in
trying to make sense of emotional and affective experiences of those who had been
subject to objectification and dehumanization (2015:xviii). Here, this might well apply to
Roussel, who was imprisoned in Mainz towards the end of World War I (Waugh, 1919);
other artists in his group experienced the war also, but there is no direct evidence of the
extent to which any were affected. Another thinker I return to later, Glenn Adamson,

4 quoting from a recorded interview.
also invoked trauma theory in analysing modern craft practice for producing many identical items by hand; crystal model makers in particular appear analogous to the studio craftsmen Adamson studied.

I chose ANT to scrutinise the collections and their histories, privileging the objects which were my only possible starting point – nothing else was generally known. Questions of why ignorance arose and the nature of invisibilities experienced by models and their makers were suggested by the objects, their documentation if or when discovered, and subsequent leads. I followed Jordanova’s approach, but not as far as Latour took it; her view was:

It is philosophically untenable for scholars to project human qualities onto objects, to treat them as if they were animate beings, however tempting, poetic and common it may be… [Agency lies with] the people who produce, commission, use and display them (2012:33).

Simon Knell (2012), Professor of Museum Studies at Leicester, agreed, arguing objects only do and mean things because people make them do so; the material object is mute. These are robust rebuttals of the common remark that displayed objects ‘speak for themselves,’ usually arising in discussions of museum labels.

**About things**

Brown began a special edition of *Critical Inquiry* dealing with things, with the challenge ‘Is there something perverse, if not archly insistent, about complicating things with theory?’ (Brown, 2001:1). He queried whether it was needed in the same way as narrative, cultural, queer or discourse theory. Perhaps things could be let alone, resting above accounts of the subject, the sign, alternative to the instabilities, uncertainties, ambiguities and anxieties fetishised by theory, and relieving unnecessary abstraction.

He noted the emergence of material culture studies (Miller, 1998), and historicism’s ‘desire to make contact with the real’, ‘objects of the external world’, however problematic that external world and however phantasmic the externality of that world may be theorised to be. Derrida had argued the ‘thing is not an object [and] cannot become one’ – so taking the side of things hardly puts a stop to theory (Brown, 2001:3).

‘Things are what we encounter, ideas are what we project’, remarked Leo Stein (1927:44). The purpose of the representational models in this thesis is to project ideas to encountering audiences. Brown suggested Stein’s comment explains the suddenness with which things seem to assert their presence and power; objects assert themselves as things in a changed relation to the human subject - less as an object than a particular
subject-object relation. The word ‘thing’ combines generality and specificity, the concrete and the ambiguous, and hovers over the threshold between the nameable and the unnameable. For Lacan, the Thing is and it isn’t – it exists, but in no phenomenal form (Brown, 2001:5); only by turning away from the problem of matter and the object/thing dialectic have historians, sociologists and anthropologists been able to turn their attention to things. Appadurai refers to methodological fetishism as ‘following the things themselves’ (Appadurai, 1986:5), with questions more about ideational effects of the material world, rather than material effects of ideas, and not whether things are, but what they perform, or the subject/object relation in particular contexts (Brown, 2001:7). Latour would agree.

Allowing objects (some) potency shows how they organise our private and public affection. Here Brown noted particularly Susan Stewart’s *On Longing* (1984), with examples about sympathising with animals and artefacts, attitudes to death and destruction of Buddha statues by the Taliban (2001:7). He reminded his readers that Latour argued that modernity artificially made an ontological distinction between inanimate objects and human subjects, and Walter Benjamin had stated the avant garde worked to make that fact known; modernism’s resistance to modernity was its effort to deny distinction between subjects and objects, people and things (2001:12).

In discussing how things are seen or represented, useful points were raised that are relevant to my work. Brown quoted Castoriadis as saying ‘However materially stable objects may seem, they are, let us say, different things in different scenes’ (2001:9), and, from anthropology, the remark by Nicolas Thomas that ‘the category to which a thing belongs, the emotion and judgement it prompts, and narrative it recalls, are all historically refigured’ (op. cit. fn 24; Thomas, 1991:125). So an item in a collection may be seen quite differently by different people at the same time or by different people at different times – finding new purpose for the models will depend on exploring new viewpoints for their future audiences. He also remarked:

To declare that the character of things as things has been extinguished, or that objects have been struck dumb, or that the idea of respecting things no longer makes sense because they are vanishing – this is to find in the fate of things a symptom of a pathological condition most familiarly known as modernity (2001:10).

Absence of respect for invisible things can occur for objects in collections where their initial worth is no longer recognised.
About copies and authenticity

The models in my case studies copied specimens or artefacts, either from life or from designs of the originator. For the makers, copying must have been an essential feature of their training. Lecoq de Boisbaudran, writing in 1879 on training memory in art, was quoted by his translator L D Luard as having said:

The merit of copies as elementary practice … depends … upon the fact that what is drawn on a piece of paper can be truly copied on a piece of paper, whereas an object in three dimensions can never be copied, but only interpreted upon a flat surface, with the result that a looseness and inaccuracy of observation and execution may pass undetected in drawing from real objects, which even the beginner himself could not fail to notice in work from simple copies (1879:x).

The copying here is to make a representation of something in other media – a two-dimensional image of a three-dimensional subject. The same volume contained advice to a young professor of art on a method of teaching reinforcing the point:

Copies are indeed especially fitted to exercise and develop the primary faculties of correctness and precision, essential faculties, which, like tools, must be sharpened before work, or the result will be sure to show signs of bad workmanship. Copying drawings is a very useful transition from the study of geometrical figures to drawing from casts (1879:105).

Emphasis was placed on being able to copy, exactly. For practical production this was essential; for individual genius sought by Academies, skill in rendering the human form from life was important for continuing students at the Royal Academy, before copying Old Masters in the advanced Painting School (Macdonald, 1970:29). Ruskin, in his Oxford Slade Lectures on Art of 1870 agreed – ‘This then is what we have first got to do…to make our drawing look as like the thing we have to draw as we can’(1892:155).

Opinion developed and changed. Although copying was a fundamental artistic skill, copied items, or items that could be copied, were then thought to lack the quality of art (as opposed to craft). Rodin, in the late 19th century (Rodin and the Art of Ancient Greece (2018)), reacted to the implication that his life-size sculptures of human figures were made from casts by producing them in demonstrably different scales, both larger and smaller. Benjamin’s The Work of Art in the Age of Mechanical Reproduction (1936) was much concerned with the capacity of an artwork to encode information about its historical period (Benjamin, 2008:9-21); a reproduction lacked the here and now of the original’s unique existence in a particular place. Marks of history experienced by the original conferred authenticity which would elude technological reproduction.

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5 Lecture 5: Line.
Reproduced, the piece could be received simultaneously by more than one observer, but its status as singular original was broken, copies or images lacking the ‘authentic’ aura of the source. Reproduction affected the perception of the source and its reception by the viewer. The complete essay, short though it was, is a major work in the history of modern aesthetic and political criticism. I suggest that copies can acquire their own auras, with diverging individual histories.

But back to de Boisbaudran, linking art education to education more generally:

> It is very generally admitted nowadays, that any complete scheme of education should include the “polite” arts, drawing and even painting as well. But the failure to understand that drawing consists of three faculties, accuracy of eye, skill of hand, and also memory, that is, the retention of one’s observations, has caused us to overlook how valuable it is in general education on account of the last of these faculties alone. For while all three are clearly equally essential to an artist, the first two can be dispensed with in general education, the last never (op. cit.:19).

The ability to draw was valuable in remembering what you have seen; memory was fundamental to general education. In his third Slade lecture, Ruskin linked artists’ ability to produce art to their moral state, communicating to other similarly moral minds (‘The Relation of Art to Morals’, 2008). The aim behind the models considered here was to communicate, and in an improving manner. Makers of successful models acted in a moral, educated way, whether seen as craftsmen or artists. How they were regarded is discussed later (thesis:165-167).

**About memory**

The widely acknowledged classicist Frances Yates (1966) showed memory in the ancient world was pictorial, sight being the primary sense. Memory involved mental mapping – walking through an imaginary landscape, filled in order with the things to be remembered. Raphael Samuel, another left-wing champion of history from below, devoted part of his book *Memory Work* to the pictorial aspect of memory, particularly for when literacy was rare, citing the Bayeux tapestry, illuminated manuscripts, heraldry, chapbooks and playing cards as examples (1994:27-39). He pointed out ‘memory ... is dynamic – what it contrives symptomatically to forget is as important as what it remembers’, conscious recollection being akin to how historians reconstruct knowledge. ‘Memory is historically conditioned, progressively altered. History involves a sense of erasures, but brings the half forgotten back to life, a consecutive narrative out of fragments, imposing order on chaos’ (1994:x).

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6 See for instance Larsen (nd but post 2005); review by Werbeck (2009).
Samuel encouraged histories of women, the poor, ethnic minorities and other once-neglected groups through the journal *History Workshop*. Keith Thomas (1995:7-8), reviewing Samuel's work, noted although some details quoted might be wrong, his enthusiasm was infectious; in *Theatres of Memory* he assembled a large number of ideas and examples. Writing about ‘unofficial knowledge’ in the introduction to *Memory Work*, Samuel commented that history was a social form of knowledge (1994:8), children sometimes were taught to read from history books (1994:7), and noted the role of masons and carpenters as visual memory keepers through representations inserted in church carvings (1994, pt. II:23-24). Memory keeping was a public activity and required audiences, or listeners. Jordanova also commented on the need for audiences:

> the very term ‘audience’ implies some kind of display and without ‘display’ there is no audience. Furthermore, ‘display’ implies people, who select artefacts and design settings for them, as well as organisations, including homes, and ideologies, that enable such settings (2012:187).

One person frequently cited as the founding father of memory studies is Maurice Halbwachs, who postulated in the 1920s that ‘our conceptions of the past are affected by the mental image we employ to solve present problems, so that collective memory is essentially a reconstruction of the past in the light of the present’ (Grensburger, 2016). Collective memory derives force and duration from individuals remembering as members of a group, each having a different point of view dependent on their position in the group (op. cit.:401), a combination of time, place and individuals, or when, where and who they were with respecting that which is being remembered.

Collective memories about the model makers were created by the people assembling the exhibitions or the public stages where the collections were displayed. Choices for inclusion in or omission from collections determined the official memory made in the exhibitions; future invisibility started here.

Also relevant was debate about the development and maintenance of hand skills in production, and the extent to which these engaged both mind and body. Glenn Adamson, when Head of Research at the V&A, examined the tendency of modern craft to orient itself towards the past, and suggested it performed memory work in the face of the trauma of the Industrial Revolution (2003:181-239). Following on previous work on the concept of the pastoral (in which, for him, removal from centres of power provided objectivity and a basis for critical observation), he suggested modern craft was routinely found in ‘marginal geographies’, and seen as part of unbroken tradition, or as revival of something lost (2003:181-182). William Morris’s view of the handicraftsman helped by tools being turned into a tender of machines was far from an accurate depiction of what
happened – thousands of skilled craftspeople were still at work, and indeed Morris used them to produce his designs. Adamson went on:

When craft was invented it was constructed as an inferior category. Craftsmen’s hands were increasingly manipulated by others; craft knowledge was thoroughly explained, so it was robbed of its former mystery; and craft itself was represented as merely mechanical. None of that though should necessarily have given rise to the idea that craft had actually melted away as a result of industrialism (2003:183).

Yet, craft ‘was also understood to be deeply necessary, and not just in a practical sense … [it] simultaneously gives shape to our desire for continuity and reminds us of the actual, tragic discontinuity of our experience’ (2003:84). Adamson viewed crafts movements as sets of cultural symptoms responding to the crisis of modernity, and investigated three forms of symptoms of trauma represented in the practices of craft revival – repetitive behavior (such as producing multiple identical pieces), false memory, and flashbacks. In particular, alternative reconstruction of the past in which craft disappears explained why ‘industrial artisans have been invisible to craft historians and practitioners, Morris included: they are screened from view by the desire for a simple story of loss’ (2003:87). Where model makers were regarded as skilled artisans, this attitude to them and their work became relevant.

In his review, Adamson invoked the work of David Pye, who made a distinction between workmanship of certainty and workmanship of risk, taking issue with many of Ruskin’s ideas; Pye also cited the Amalgamated Society of Engineers (ASE), formed in 1851, as key to positioning craft as a driver into the future rather than repository of the past. The ASE also formulated modern perceptions of industrial craft; it opposed piece work pay systems (driving down wages and increasing work rates) and wage cuts in times of economic distress, and promoted the limiting of working hours. More controversially, it supported official demarcation between skilled artisans and unskilled labourers and apprentices - skill should be recognised and justly compensated (2003:201). Modelling skills were recognised by those choosing the makers, but, as will be shown, recognition was often not long-lasting after the objects were handed over and entered their first active lives.

John Mack (2003), Keeper of Ethnography at the British Museum, explored the relationship between objects and memory. He aimed to show how people world-wide have used material culture to ensure a past is remembered, not the past, contrasting memory and history as alternative means for its understanding. Examining how portraits

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7 Reviewed by Mithven, 2003:52.
are used to create memories, he stressed the significance of attaching names to images, or transforming the anonymous into the specific, facial resemblance being often of marginal significance. The distinction between identity and likeness is also debated in art history, and is directly applicable to naming crystal shapes (thesis:49).

Mack emphasised the importance of photography as a tool for triggering memory, assigning photographs an authenticity unachieved in other media. Within museum practice, matching contemporary photographic evidence with the related objects is appreciated far more now than sometimes in the past – the NMS’s ethnographic photographs are examples (thesis:199-201). Photographs’ potential as exhibits in their own right was also explored, and whether they were seen as and shown alongside other genuine specimens, art or artefacts (Crane, 2013:123-139). Since, the status of photographs as art as well as information has been recognised by a series of exhibitions held in national museums. Tate Britain (London)’s Salt and Silver – Early photography 1840 - 1860, and NMS’s own Photography - A Victorian Sensation, were staged in 2015. The Royal Photographic Society (headquarters in Bath) sold its collection of 250,000 photographs and artefacts to the National Museum of Media, Film and Television (Bradford, Yorkshire) in 2002, whence it was transferred to the V&A (London) in 2017. Photography as art is now given serious attention and seen as important.

**About museum objects**

The University of Leicester’s Department of Museum Studies was set up in 1968, the year Michel Foucault published The Order of Things, a work which, as Knell, series editor of its Readers in Museum Studies, remarked, greatly influenced much museum thinking. The Reader on museum objects was edited by Sandra Dudley (2012), using Jean Piaget’s constructivist approach whereby people learn by making meaning from their experiences. The volume looked in detail at individual objects and the nature of related human interactions, and aspects of interpretive practice in museums and elsewhere. Starting with the object enables both the richest kind of museum experience and the fullest knowledge of the object’s original and later contexts (op. cit.:xxvii- xxviii).

These experiences may need to be fought for. Geoffrey Batchen, studying a Victorian photograph locket, noted that speculating to bridge the temporal and emotional gap between object and viewer, although well established in photographic discourse, had generated opposition in postmodern times (2012:84).

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8 Batchen cites an overview of debate in Moxley, 2001:103-142.
distinction from one another’ (Rogoff, 1998:17-18). Sam Alberti reminded readers of the significant amount of handling and processes any object passes through whilst museum staff attempt to ensure it survives indefinitely (2012:90-94). I suggest this handling contributes to the object’s Benjamin-style aura, leaving traces that may be interpreted later.

Julie Marcus compared the apparent heterogeneity of cabinets of 17th century curiosities with the orderly taxonomic displays of 19th and 20th century museums. Neither approach was completely correct, but their visual conventions continued into museum practice today in interesting ways. She cited a large showcase illustrating the foundation of Sydney and its colonial culture, containing hundreds of objects,

used to reveal the artifice of knowledge, the absent space of truth, and to devastate narratives of space and time. What is not displayed is the guiding hand which determines what knowledge shall be revealed, the hand of power (2012:189).

In this case study, Marcus felt the display constituted a lie. Because truth is fragmentary, evaluation and narrative are impossible, so the truth cannot be either known or reconstituted from a distance. For me, evaluation and narrative depend on the information considered, which is the part that is incomplete. Further, Marcus suggested the ‘really big lie’ was that the spectator does not need to know what curators and designers know about the displayed items. She went on to compare her museum’s dioramas to Dutch panoramic paintings; both used deceptive perspective, large foregrounded figures and small back-grounded ones, the absence of a frame or concern for surfaces and detail. As an example of the Hobsbawn-quoted Renan remark of how history can lie (thesis:28), this relates strongly to the dioramas in my study, although they usually do have window-like frames.

The impact of a single object is of a different quality to that of many objects viewed together, the more usual offer to museum visitors. The grouping appears as a collection, and exhibitors, Marcus explained, choose how much assistance they give to admitting their selections and choices for what is shown. In On Longing, Stewart (1993:151) compared how the ‘souvenir’ and the ‘collection’ are objects mediating experience in time and space. The souvenir is an object appearing out of context, from the past appearing in the present. In contrast, ‘the collection offers example rather than sample’, and ‘whereas the souvenir lends authenticity to the past, the past lends authenticity to the collection.’ The collection replaces history with classification, order beyond temporality, and reframes objects within a world of attention and manipulation of context, forming new contexts. ‘The spatial whole of the collection supersedes the
individual narratives that “lie behind” it’ (1993:151-153). And ‘it is the museum, in its representativeness, which strives for authenticity and for closure of all space and temporality within the context at hand’ (1993:161). Stewart quotes Eugenio Donato; museum displays are sustained by the fiction that they constitute a coherent representational universe, by ordering and classifying (1993:161-162).

Reflecting on my case study collections, it is worth noting that none were gathered purposefully – no-one set out to acquire all possible crystal model sets, or all the architectural models of St Paul’s Cathedral ever created, or all the dioramas commissioned by the Science Museum. Individual crystal sets could be seen as Stewart-style collections, whereas the architectural models were more like souvenirs. But Stewart’s discussion does apply to institutions’ holdings once their accumulation was acknowledged, the selection of items from storage for display, and choices of new contexts whether shared with audiences or not. A pre-existing object acquired by the museum had a prior use; one commissioned for a particular exhibition loses context when removed from display. In the Cathedral, after completion of the work of which they were part, the status of the models changed from active tool into something more like museum object.

1.3 Methodology: Applying Actor-Network Theory (ANT)

Finding a framework within which to analyse the histories of these three collections of models and their makers proved challenging. The usual methodologies from sociology and educational studies did not seem to fit; as a result of my project work, some of the behaviours and attitudes of people in the institutions where I worked changed, but not in the reflective, cyclical manner of action research. Quantitative methods were inappropriate; I could not carry out questionnaires or interviews as most of the people involved were long dead. Addressing the question of what kinds of makers the model makers were called on cultural, art and educational histories. As a former museum curator, I was used to privileging the museum object. So as my starting points were non-human (the models in the collections), Actor-Network Theory encouraged inspection of the interactions that might have taken place in the course of creating the models in the first place and their subsequent uses.

Initially, ANT was deployed to address three rather different ways of dealing with agency, linked to nature, society and the building of meaning. Latour (1996), reviewing ANT over a decade after its introduction, developed some of the properties of networks and explained some misunderstandings that had arisen, not least from the use of the word ‘network’. An actor-network is not made up of fixed paths between set nodes, nor
is it restricted to individual humans, but it can include artefacts or ideas. Ties or connections between actors may be weak, but do not depend on physical proximity; Latour quoted the example of someone in a telephone booth, physically near to the person in the adjacent booth, but more closely connected to the person to whom they speak on the telephone. ANT was an attractive framework for bringing sense to the components of an aggregation of artefacts and people inside an institution, and showing how the institution uses them.

Surveying ANT applied to the history of education, Fenwick and Edwards (2012:x-xvii) emphasised the following aspects. A ‘network’ is an assemblage of materials brought together, linked through processes, which together perform an enactment. Human and non-human members of the network are treated in the same way. Networks can extend across broad space, long distances and long time periods. Analysis focuses on negotiations at points of connection between members of the network, and concentrates not on what texts and objects mean but what they do. Assemblages of connections (‘actors’) can exert force. ‘Translations’ take place when entities connect and change one another to become links.

All objects, persons, knowledges and locations have relational effects. ‘Immutable mobiles’ is a term given to network members acting at a distance (Latour quoted textbooks as an example). They may be only visible in one network of relations; they can be silent, ignored or overridden, but develop enough solidity to be able to move about (even literally) whilst holding these relations in place. Some immutable mobiles become obligatory points of passage, central assemblages through which all relations in the network must flow at some time.

Fenwick and Edwards included a case study by Nespor (2012) applying ANT to training videos and assistive communication gadgets, investigating how associations between people and things are accomplished. Non-human artefacts may deflect attention from their makers (the very situation I have attempted to redress) and from other humans controlling their use, access, power and products, thus rendering both makers and their work invisible. In some technological applications of ANT, focus has been on devices in a network process, but processes also depend on things external to the network. Individuals at points of entry to the network tend to be high status, foregrounded over mid- or lower-level workers.⁹ Where this has happened, I suggest Nespor has not used

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⁹ A fellow researcher had to justify using ANT applied to the history of the use of mathematical instruments in geographical exploration against the perception that ANT privileged elite or high status individuals. – Jane Wess, personal communication, 12 Dec 2016.
the network concept to full advantage; one of the stronger aspects of the approach is to bring silent, unprivileged or indeed non-human characters to the fore.

My focus being models, the idea of non-human actors appealed. Taking an individual model and studying its history allows many more humans to be shown to contribute to the full story, giving a richer, more nuanced understanding of what exactly happened. Some actors remain unknown and invisible, although their presence can be inferred or deduced. These three collections accumulated over two centuries. The commissioners of the models, the people who made them, the audiences for which they were intended, and the people who ultimately ended up with them in their care vary enormously in status, intention, attachment, background knowledge and indeed, value judgements. In order to address the invisibility of the primary producers, the model makers, I now consider how various aspects of ANT arise in their stories, who or what the actors were, and their relations with each other. I apply ANT concepts in general terms to the study collections; concepts concerning non-human actors, including models, are discussed first, then those relating to human actors, including the model makers.

Diagram 1 shows a generalised potential network for a single model, accepted into an institution; in practice, each network has variations, as detailed in Chapter 2. The large outline represents the institution, active aspects of idea development, policy and public use being mainly in the upper part. Maker and audience may be either within or external to the institution, so are shown at the edge. The lower part deals with model handling and management. To the right, non-institutional aspects significant for the active life of the model are shown; less determinate connections are shown as dotted lines.

Diagram 1.
The *non-human actors* in a collection actor-network include the owner institution, the models, their documentation (in storage or on display), related sources and ideas, sites where the models are stored, shown or worked on, archives and library materials used in their construction and subsequent use, and controlling institutional policies. All three institutions own other collections, to which their policies also apply. The models share an ambivalent position within the institutions’ holdings, of lesser status to other, more ‘real’ possessions – architectural models are not seen in the same way as church silver, crystal models as mineral specimens or dioramas as working patent models. NMS owns other crystal models, such as models of famous diamonds, and ball and rod models showing internal structure; I restrict my study to generalised models showing external shape, which share conceptual histories. For dioramas, I omit parallel but separate histories of natural history dioramas, and for architectural models, deal only with those associated with St Paul’s Cathedral.

Institutional sites include off-site storage. NMS has stores at Granton, Edinburgh; the Science Museum, in Hammersmith and Wiltshire. Archives are held mostly in the main institutions, their libraries, and stores; much Cathedral material was transferred to firstly the Guildhall Library and then London Metropolitan Archives. For physical models one ANT *obligatory point of passage* occurs at the moment when the model is regarded as complete, and another when it formally enters the institution’s collections. There may be archival evidence marking these moments, acquisition being sanctioned by institutional managers, with peak visibility for both model and maker.

Physically, the spaces occupied by the collections vary. Crystal models tend to be larger than specimens, for comfortable handling, but so numerous they require comparatively extensive storage. The Cathedral’s architectural models were either displayed, in several parts of the building, or mostly dismantled, in space that was physically awkward to access. Dioramas removed from show occupied storage pallets, and, being both fragile and bulky, raised serious questions about retention if there was no prospect of further use. Moving architectural models is complicated, but undertaken for discussion, exhibition, conservation and loan. Science Museum dioramas were mainly static; those of the Imperial Institute, Museum of London and Wellcome Museums were surprisingly mobile, travelling to international exhibitions and world fairs as far afield as Brazil and Japan, for the Department for Overseas Trade.

As a model embodies the originator’s ideas, mediated by the maker’s skills, the ideas themselves can be regarded as ANT *actors*. References from which the models were made are also non-human actors. Crystal models were based on actual specimens
(themselves potential actors, but invisible here), or representations, such as drawings with various degrees of idealisation or illustrative plates in texts. For architectural models, references could be drawings created beforehand, such as Wren’s schemes for the Cathedral, or plans prepared later from measurements of the actual building. For dioramas, scenes portrayed represented actual events or sites; the makers worked from personal experience, visits, photographs or other illustrations.

The models present an ideal natural specimen, or miniature building, or idealised scene, to the intended audience, convincingly. John Constable, disappointed at the Daguerre Diorama, a much larger spectacle with a seated audience, bemoaned the fact that his eyes were not deceived by painted effects (Altick, 1978:188). I suggest this missed the point, to convince rather than deceive. Crystal models could be viewed without harm to specimens; architects and critics could inspect a small model from all angles to check effects of various details, and dioramas showed engrossing scenes as if through a window at processes or events that could not be feasibly recreated within galleries.

All were attractive, and robust enough to tolerate the impact of being viewed, to survive their active lives, with little external assistance. The client stage-managed the desired effect, or the impact of the reveal to the customer. For instance, one purpose of the Great Model of St Paul’s was to allow (selected) people to duck underneath it and view the inside as if for real. The aim was to convince King Charles II that if built the Cathedral would be spectacular; once it WAS built, display of this stunning model continues to generate income for Cathedral coffers.

Handled carefully, the models would not degrade (much) in storage and could perform again with similar results. In ANT terms, they were immutable mobiles, remaining essentially static over time, even if physically moved around. The meanings, associations and other relations that brought them into being were not invalidated by a change of venue or the passage of time. Like a textbook on a shelf, the words stayed the same, even if no-one read them. The relevance and value of the textbook /model does shift, with society’s attitudes to the science/story/representational medium. Marks from handling or use, the source of Benjamin-like ‘aura’, might be interpreted later.

Relational effects hinge on the representational nature of the models, all showing idealised versions of reality. For crystal models, relational effects exist between an individual model and the specimen from which it was copied, or intermediate or idealised drawings, the idea of the originator and what they wanted to show. Success or otherwise depends on the makers’ skill, usually accommodating a change in scale. Architectural models illuminated matters of construction and decoration, being consulted
and argued over even if the architect was absent. Dioramas usually appeared in context with other display items. The maker’s identity was neither essential nor integral to the on-going message for any of the model types.

Demonstration of how an inanimate model might nonetheless exert force can be seen in the reactions of both myself and my volunteer on seeing the Watt crystal models for the first time; both of us were so intrigued we went on to devote significant time and effort to their sorting and collection care. Architectural models have long been acknowledged as carrying considerable persuasive power, to the extent that there was even a competition where it was specifically stated models were NOT to be submitted (thesis 93). A long-standing feature of galleries containing dioramas was the need to clean showcase glass of nose and fingerprints on a daily basis. Force is exerted when two or more actants come together, such as when model and viewer arrive face to face (to use a human-oriented expression). Where participants are changed by the encounter, ANT translations have taken place.

Human actors include the people who commissioned the models, those who prepared the construction and (of course) the makers. Initiators of models may have no association with current owner institutions. Models could be bought or donated after unknown active lives elsewhere. In the making, other actors may include scientists and students, illustrators, writers and publishers, technical staff of workshops and studios, intermediary agents and suppliers. After handover, other people engage with models to varying degrees according to role – curators, cleaners, conservators, designers and exhibitors; sales staff, visitor guides, education staff; administrators who manage funding and upkeep; and audiences, from deeply interested researchers to visitors walking past a showcase.

The time spent by human actors in the networks also varies, but for all three collections, there were significant individuals in place for several decades. This continuity (notably less feasible today) illuminated institutional practices and how consistently they were applied. Issues of individual status and visibility were demonstrated in various ways. For instance, human actors’ comments could become non-human actors, such as newspaper reports on Imperial Institute dioramas. The reports prolonged their visibility, for some being the only remaining evidence of their existence. The reports were invaluable in unpicking back stories of the models; increasing availability of digitised sources has notably facilitated this study.

All three networks are of lengthy duration. St Paul’s has housed architectural models since 1674, the earliest crystal models in NMS date from about 1790 and the earliest
diorama in the Science Museum from 1931. Not all survive, for reasons given in individual stories; models may be stored for lengthy periods between moments of attention; others have higher profiles. When the newly-created model is handed to the customer, it enters its first active life, for the intended purpose and audience, with a desired outcome in the minds of the commissioners. How long this lasts varies enormously.

The collection stories informing my research feature negotiations. Some of these are evident – public debates surrounding decorative schemes for St Paul’s Cathedral in the late 19th century, for example. Others lacking evidence can nonetheless be implied; for a model to exist at all, someone wanted it, and aspects of construction would be discussed and resolved by the idea holder and the maker. Tracing these stories illuminates discussions between idea, display and, ultimately, disposal.

Associations occur between actors in both formal and informal ways. How someone first gets the idea for a model may depend on seeing something similar elsewhere, wrestling with a particular problem, or wanting to communicate to a particular audience. For crystal models, the scientist had to find a maker with the requisite skills and prepared to create the finished work. The late 18th and early 19th century examples in this study were technicians already employed in universities, students or assistants. Sometimes the scientist was intermediary between the model maker and a rich patron – Haüy in Paris, Jameson in Edinburgh (thesis:64-65, 53). The geologist Warington Smyth lectured with models to would-be science teachers; Jordan, his deputy at the Museum of Practical Geology, linked the academic world through curatorship and publishing (thesis:66). Students – enthusiasts, trainee teachers, miners – associated with their instructors, the models they were shown, and texts they chose to read. For the architectural models of St Paul’s, an obvious association is with the building itself, with the Dean and Chapter controlling and financing any work taking place, approving (or not) the recommendations of the Surveyor of the Fabric, or working with external consultants from the wider architectural sector. Hobby modellers worked independently, choosing their own materials (matches, plaster, card, wood), association arising by offering the model to the Cathedral, or through exhibition. South Kensington museums were influenced by (experienced ANT-like force from) the popularity of the Imperial Institute’s dioramas, and by association ordered models of their own. There was no official recognition that the artists worked for more than one institution; only by comparing the dates of orders in the separate archives was it possible to uncover this.
2 Models

2.1 Introduction

Initially, two works discussed below were particularly helpful in general terms; I then report on each collection with a brief survey of its wider context and literature. James Roy King, a professor of literature with huge personal enthusiasm for models as 'anthropology of experience' (1996:1), engaged with model makers he described as craftspeople and artisans, in a 'kind of paradigm of all experience' (1996:3); his book was arguably my most useful general guide. His interest started with toy trains in childhood, then architectural modelling. The pages devoted to model buildings discuss size and scale (1996:12-13), detail versus impression, models and miniatures (the latter term referring to small items resembling the real thing, never working models) (1996:19). An overlap between architectural models and dioramas occurs with doll’s houses, spectacular examples including Queen Mary's Doll’s House (UK) and Mrs Thorne’s Rooms at the Art Institute, Chicago (1996:41-45). Discussion of technical challenges included an anecdote of a conversation with another modeller about window mullions (1996:52); this struck a chord as when I visited an architectural model maker at work, he was testing sheets of acrylic and various glues to replicate multi-paned windows, in a method used by 19th century modellers with glue and card (Richardson, 1859). Materials include plaster, bones, clay, stone, paper, even food (King, 1996:71). Paper or card was and is much used, for rough architectural concept models in the studio, commercially-produced cut-out kits for objects from dinosaurs to pendulum clocks, and the many buildings required for railway layouts (1996:76). Models in clay were exhibited by Christopher Pinchbeck in London in 1750 (1996:114); Benjamin Pollock’s toy theatre collection, assembled from 1900, is still open, near London’s Tottenham Court Road. King devoted a chapter to explaining structures as a key part of the architectural model genre (1996:148-175). He gave a brief history of architectural modelling, citing models depicted in Middle Ages mosaics and paintings, notable models from the Renaissance and 17th century and contemporary examples in China, Japan and the United States. Many of the models he discussed so enthusiastically are by makers he does not or cannot name.

Another valuable resource was Karen Moon’s Modelling Messages (2005). Her interest was the contemporary architectural model and its future, rather than history of modelling.

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10 King noted the St Paul’s Great Model along with ‘Fugazza’s model of the Pavia Cathedral and the Vatican model of St Peter’s’ as examples of very large models.

11 An English embroidery depiction of Edward the Confessor holding a model church, 1328-1354, V&A 838-1902, was displayed in Opus Anglicanum, V&A, 2017.
per se. Some makers were identified, and she gave a contemporary take on model utility. Perceived importance of architectural models fluctuates with context, purpose and fashion, but mainly carry the architect’s name, with the maker (if different) frequently unacknowledged. Models survive with the architect, the client or elsewhere, if someone else shows interest; both survival and visibility are problematic. But, like scientific models, their fitness to explain designers’ ideas depends critically on the makers’ skills. The book was both impressive and deeply annoying; Moon, a design historian, scoured printed sources, occasionally covering three centuries in one sentence, but omitted a bibliography, and her interviews with practitioners are uncheckable. Reconstructing her reading list revealed multiple uses of limited sources, indicating the absence of attention paid to modellers in architectural literature. Related literature is dispersed, diverse and occasionally hard to find, contributing to the withering of appreciation of the value of models.

It was no surprise to find overlaps between King (1996) and Moon (2005), particularly the book/catalogue Great Models (Buttolph, 1978). King acknowledged a handful of works themed around single architects, 12 general works on architecture, 13 and guides to collections at the V&A 14 and Sir John Soane’s Museum. 15 Works on model-making included manuals by Janke and Pattinson, on doll’s houses by Earnshaw and Eaton, on specific models by Branch and Briggs, and on individual makers by Packer and Peters. Another work used and acknowledged fulsomely by Moon was Akiko Busch’s The Art of the Architectural Model, 1991, focusing on presentation (and therefore realistic-looking) models rather than conceptual models or other forms used during the design process.

The National Art Library catalogue uses two relevant terms – Models and Modelmaking and Architectural Modelling. The first category held 18 titles relevant to my thesis, five featuring buildings in their title or description, seven the use of card or paper, and one plastic. Architectural Modelling produced 27 titles; most concerned doll’s houses, three paper models 16 and the remainder more general approaches. 17 The same searches at the Royal Institute of British Architects (RIBA) produced a small number of further references – six books, one archival item and the rest journal articles. Curiously, this is both very thin compared to the number assembled by Moon, and has very little overlap with her listing.

12 Downes and Whiney - Wren, Brownlee and Delong - Khan, Kuran – Sinan (not checked)
13 Lynch, Schuyt and Collins (not checked).
14 Bryant (1986).
16 Richardson (1859) and Blasche (1824) and (1830).
17 Forman, Christiani (18th century Italian), Wickham, Cowan, Hendrik (not checked); Janke, Buttolph, Moon, Hobbs – see bibliography.
2.2 Crystal Models in the Natural Sciences Department, NMS

Introduction

I encountered the NMS crystal models in 2014, whilst visiting the Museum’s Granton store. The models had not been on show for years (not within living memory of any of the staff there, at least); the rationale for retention was becoming vague. The models formed a small sub-collection within mineralogy and geological collections. Some were formally entered in the museum’s inventory, run departmentally at the time of most of the acquisitions (later, consistently across the whole museum). They were partially sorted; I checked the specimen stacks for models stored alongside. After physically co-locating similar shapes, I searched inventory records for their provenance. Being partially supported by a grant from the Scientific Instrument Society, I published the results in their Bulletin (Insley, 2015b).

Reviewing this work with ANT and my research questions in mind, there are several over-arching observations. Crystal models, the primary non-human ANT actors, were not seen as ‘real’, or regarded as highly as mineral specimens, but rather as descriptive and educational devices, explanatory tools, for use in talks and lectures. The models embodied ideal forms of particular crystals (unknown originals, also non-human actors) for handling by human actors (scientists or students). Their source was of little significance. As a result, sets of models were largely incomplete – models were missing, misplaced, borrowed but not returned, and lacked evidence to indicate when this happened.

My interest increased the collection’s visibility. Another department (Science and Technology) showed interest in the models, raising the value that the mineralogical section placed upon them. Another scholar, Johan Kjellman of Uppsala, had seen my earlier paper (Insley, 2011), and consequently visited the store, raising the collection’s profile. Following my initial sort, I could suggest, without specialist mineralogical or crystallographic knowledge, where gaps might be; the staff are alert for models still located alongside specimens. The models exerted force, in ANT terms, having made an impact on myself and Kjellman; our interest caused other museum staff to take greater interest in the crystal model holdings, even without wider appreciation of detail of their sources, provenances, makers and uses. Subsequent work aimed to clarify these.

Initially, I envisaged the crystal model actor-network to consist of models, makers, identifying textbooks, the museum and the scientific staff. The institution housed them all, with controlling policies determining their continuing use and survival (Diagram 1,
thesis:40). The commissioning client is influenced by sources for the idea of the model; maker and audiences can be either internal or external, and are shown overlapping the institution boundary. Various staff, possibly including the client, prepare the models for audiences. When no longer required, models are stored, knowledge of their existence maintained by secondary means – documentation, images, etc. Opinions expressed by (vocal, influential) audiences may affect policy makers within the institution. Trades involved in producing accompanying text are generally external to the institution; the network widens to include makers, working externally to the museum, and suppliers of model sets acquired from elsewhere), and audiences, either internal or external, possibly including auto-didact makers, but who are only directly affected (experience force from the models) if they actually see or handle them. Most of the models can now be named, giving them more visibility; makers were generally still unnamed, although some scientists responsible for systems and sometimes their student assistants were identifiable from documentary sources. Despite their primary purpose being over, the models exerted force on me, Valerie, and Kjellman in Latour’s sense; we responded to their appeal by travelling to see and work with them ourselves. Negotiations resulted in my being allowed to work in the stores, enhancing the models’ visibility to their own and other departments (Conservation, Science and Technology). Considering networks helped to bring out previously underappreciated significances of the extent of self-help, manual skills, and other invisible players (previous owners such as Thoms, agents such as Highley, illustrators such as the Lowrys and Mrs Davies, and publishers of relevant texts such as Murby).

Identification

Identifying the James Watt workshop models depended on finding an 18th century mineralogical text illustrated with plates, showing crystal shapes marked in the same rather unusual manner. Model, text and illustration, as ANT actors, sustained relations in that actor-network. Knowing the models’ approximate dates (1782 to 1819, the time during which Watt lived in the house), and using published indexes to Watt family papers, I found appropriate texts (Lösher, 1796 and 1801). Actors in the actor-network enabling this matching included the author of the text (Carl Immanuel Lösher), the draughtsperson who had done the drawings for the plates, the engraver, the publisher, the institution for which Lösher worked (the Freiberg Akademie) and the scientist whose ideas Lösher was discussing (Abraham Gottlob Werner). Watt’s elder son James Junior had studied with Werner, and was the most likely owner of the crystal.

18 With support from staff of three libraries (Natural History Museum, Science Museum and the Cambridge University Library).
models. This was evidenced by the discovery of a letter from father to son, suggesting that identifying mineral samples (‘discriminating fossils’) by external appearance alone could only take someone so far, concurrent scientific debates suggesting chemical analysis was a better method (Insley, 2011).

Trying to identify the other sets in the NMS network resulted in finding matching texts (immutable mobiles) for models designed by Robert Jameson, L’Abbé Haüy, John Joseph Griffin and G M Davies; still to be fully identified are models in a set by Gustav Rose, a friend of Griffin’s. In addition, anonymous museum technicians created models for display in 1911 based on the Rose set; the display was amended a few years after its first iteration, demonstrated by mismatching numbering on individual display stands, and the discovery of two identifying catalogue lists. For some models, invisibilities continue – source texts and scientist designers are still unidentified.

Naming a model could occur in a number of ways. Crystallographers named shapes, ranging from the simple cube to, say, a *trigonal-triakis tetrahedron*.¹⁹ Mineralogists gave the model a chemical name including an adjectival descriptor to show which variety it represented (such as *Chaux carbonatée progressive*). Same-shaped models might have different chemical names, models with the same names different shapes (Griffin, 1841) (Plate 4). For the massive Haüy sets, labels were handwritten, and attached individually. Over time, many of these had been displaced or torn; without a definitive list it was impossible to say what the set should contain. The larger Haüy set of two in NMS collections also had a handwritten numbering system running to 888; there were 13 identical cubes numbered 1, 19 identical models numbered 2; over 300 numbers had multiple models. This (unexplained) system must have been applied by museum staff in 1915, post-acquisition, over a hundred years after manufacture. Matching most but not all models to shapes was possible via a contemporaneous text (Haüy, 1801).

One particularly revealing set was a group of card models, purchased in 1992, with a leaflet containing much background information. The models were available either made up (by an invisible maker) or in the form of flat patterns or nets, for the (equally invisible)

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¹⁹ NMS 1917-5, Item 70.
1. Mineral with list of model shapes of its various forms (Griffin, pt 2, p.16)

2. Shape with list of minerals (Griffin, pt 2, p.98)

3. Catalogue description of the models, (Griffin, pt 2 p.124)

4. Crystallographic description of Model 24 (Griffin p.125)

with a low three-sided pyramid upon each face; and Model 24 is a tetrahedron, with a low six-sided pyramid upon each face. The general

5. Plain English description of Model 24 (Griffin p.99)
purchaser to assemble at home. ANT gave a new perspective on the potential identity of model maker as interested lay-person, attempting to self-educate, and the role of the publisher, in this case, of both the nets and the book upon which the designs were based. Following references in reverse for this set and its precedents demonstrated self-help pedagogy available in the 19th century, linking the models to the sciences of mineralogy and crystallography through allied reference books (Insley, 2017).

**Professor Robert Jameson**

The most prominent human actor in the network, and head of the University of Edinburgh’s Museum of Natural History, Professor Robert Jameson (‘client’ in diagram 1, thesis:40), controlled acquisition and use of items in the collections for half a century, from 1803 to his death in 1856. How much he used the crystal models is not obvious. He assisted Revd Dr John Walker, Regius Professor of Natural History at the University of Edinburgh through the 1790s, succeeding him in 1803. Matthew Eddy (2008), studying Walker’s contribution to the Scottish Enlightenment in the second half of the 18th century, noted two particularly successful teaching aids – showing and experimenting on specimens from the Natural History Museum, and providing printed lecture outlines with margins for notes. Class lists survive (2008:42-43); student notes, found in their owners’ subsequent libraries, form valuable sources for Walker’s work as he never published. Fees were paid directly, so if fewer students attended lectures, his income was reduced. Walker collected plants, minerals and a library to match, encouraging his students to do the same (2008:102-117). Influenced by Swedish scientists Torben Bergman, Johan Wallerius, and Axel Cronstedt, he developed a system of classification from his own experiments and observations. The same authors also influenced Werner in Freiberg, Saxony, who was twenty years younger than Walker, but reached different conclusions. After his Edinburgh studies, Jameson also studied with Werner, translating his writings into English, and founding the Wernerian Society of Edinburgh (2008:130, fn. 33). The earliest dateable crystal models in the collection are three partial paired sets of models after Werner’s ideas about crystal shapes and growth (the ones I first saw). They lack accession information, but may date from Jameson’s time in Freiberg. The first crystal models to enter the collections officially closely match illustrations in Jameson’s own book, *A System of Mineralogy*, (1804), the second edition (1816), and a further work in 1817 (Plate 5).

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20 One may be a gift from the family of a fellow student of Jameson’s from Freiberg – my thanks to Peter Davison of the Natural Sciences Department, NMS, for the reference, Sweet (1967), to this possibility. Davison, P. (2017), Email to myself, 10 April 2017.
1. Jameson’s models, sorted alphabetically

2. Jameson (1820), plate 1 [NHM Lib]

3. Larkin (1820) [NHL Lib]

4. Plate engraved by Delvalle Lowry [NHM Lib]

5. Mrs L. recommends materials for model making [NHM Lib]
The Crystal Model collection

The first acquisition entry was vague: ‘1816-1817 NH 13. Crystal Models. Three Hundred. Purchased.’ There were 39 larger models, and 212 smaller ones, made in wood and stamped with mineral names. Names on seven of the larger models matched illustrations in the 1804 System and, more compellingly in a way, the sizes; the smaller models had 50 names between them, all appearing in Jameson’s 1816 and 1817 texts. In Annals of Philosophy (1816) Nathaniel Larkin announced by letter that he was proposing to make a set of models to accompany ‘the third edition of Jameson’s Mineralogy in 1817’.

MODELS OF CRYSTALS. (To Dr Thomson)

Sir, I have just executed some models to accompany Jameson’s Characters; they are in two boxes, one of which contains 34 models of the first two plates of the above work, to illustrate Werner’s Crystallographic Method: the remaining are 19 primitives. They are numbered after the above plates, the first the letter F, and the others with P. The price of the whole is one guinea. They may be seen at Mr Mawe’s, Strand; Mr Bate’s, Poultry; and Mr Jones’, Holborn. I purpose making a complete set to accompany Jameson’s Mineralogy in the same style, consisting of 249 figures for 4l. 4s., with the names neatly stamped on each model.
I am Sir your most obedient servant. N I Larkin
11 Gee-Street, Somers Town, London. (1816:315).

Jameson recommended Larkin’s models to his readers. ‘NB for facilitating the study of Crystallography Models are made by artists. I would particularly recommend those executed by Mr Larkins [sic] Somers Town, London’ (1817:viii). The simultaneity of publication date and register entry suggests the maker of the museum’s models was Larkin. There is no direct evidence of formal collaboration. Larkin clearly admired Jameson’s work and intended to produce matching sets; Jameson in return alerted his readers to the facility Larkin offered, but without spelling his name correctly. Jameson’s plates were mostly engraved by E Mitchell, who worked for several university writers from 1800 to 1829, not altogether successfully as he spent a period in the Sanctuary (an area sheltering debtors) from 1826 (Mitchell, 2019).

Investigating Larkin as a human actor in the crystal model actor-network showed him to have a slightly higher profile, outlined by Wilson and Kjellman (2015:269-276). He described himself as a teacher of crystallography and mathematics in a book he wrote on solid geometry, illustrated with plates from his own drawings (Larkin, 1820). The plates were signed by two names – ‘W Lowry’ for some, and ‘Miss D Lowry’ on others, both being acknowledged on the title page. Initial inferences were that they were related
and worked together, Miss Lowry not only engraving plates commercially but signing them. This is intriguing, but not unusual; families worked together in certain crafts. The detail was rather more interesting. ‘W Lowry’ was Wilson Lowry who began training as a surgeon but switched to become an engraver through the Royal Academy (Lowry, 2016). He was a founder member of the Geological Society, elected to the Royal Society in 1812. His second wife Rebecca was a mineralogist in her own right. Their daughter Delvalle wrote and illustrated Conversations on Mineralogy (Varley, 1822), married landscape painter John Varley in 1825, and continued to produce mineralogical works. Both Larkin and his engravers were well-connected in London scientific society (Insley, 2018).

The Conversations book genre was one of the few ways literate, well-off women could engage with the sciences of their day, noted Barbara T Gates (1998:42-43). Most influential was Jane Marcet’s Conversations in Chemistry, which inspired Michael Faraday’s interest in chemistry. Delvalle’s Conversations in Mineralogy followed two young girls Frances and Mary, and their mentor Mrs L. It featured direct observation (the first conversation takes place just after the two girls return from a visit to the British Museum), comparison with specimens owned by Mrs L. and hands-on experiments involving measurement and even blowpipe work. It was very popular.

Gates also remarked that Charles Lyell started to write Conversations on Geology, as a companion to Marcet, but reconsidered, publishing Elements of Geology instead in 1838. The Conversation form already had distinct overtones of women’s talk, and thus might have undermined the authority of Lyell’s topic. Through the 1820s and 1830s Conversations were employed by women to introduce nearly every branch of science. With my own research interest in people’s visibility, I was also struck that I only found Gates’ book because the illustrations including Delvalle Varley’s frontispiece were entered individually in the library catalogue.

The Conversations Preface gave more background:

Knowledge of mineralogy may be attained from the private instruction given by Mrs Lowry (at her home in Titchfield St) who has for several years devoted a great part of her time to the completion of a very extensive and valuable collection of minerals (1822:vii).

She also suggested readers wishing to start their own collections could buy from either John Mawe at 149 Strand, or G B Sowerby of King St Covent Garden., and ‘Wooden models of crystals (such as are occasionally spoken of in this work,) are made by Mr N
J Larkin and may be purchased of him at Gee St, Somers Town, or of Mr Mawe’ (1822:viii).

Delvalle Lowry Varley was one of the few authors I found who described using model crystals in informal or self-education. Furthermore, she, or rather Mrs L., encouraged her young charges to try to draw their own crystals, and even make their own models. When Mary, the practical one, points out she doesn’t have either planes or chisels, Mrs L. smoothly goes on to suggest potato, turnip or even cheese might form a good substitute for wood (plate 5.5).

A later volume, *Rudiments of Mineralogy* (1848) written by Delvalle, and illustrated by her brother Joseph Lowry, also an engraver (and incidentally named after Joseph Banks), was effectively a grown-up version of *Conversations* – the text did not involve three characters, but was straightforward description.

**John Joseph Griffin**

Another human actor in the crystal model actor-network was John Joseph Griffin, better known as a supplier of accessibly-priced scientific apparatus. His name is associated with the next set, registered in 1840. ‘1840-1841 NH 4 Crystal Models. Presented. Messrs Griffin of Glasgow’ in one source, ‘purchased from Richard Griffin and Co of Glasgow in 1840 for £4:17:0’, according to another. Again, there is a contemporaneous publication of a matching text, John Joseph Griffin’s *System of Crystallography* (1841), describing a set of 125 model crystals, made from biscuit porcelain. The museum collection also included ‘1852-1853 NH 18 A collection of 120 models in biscuit porcelain of the most important natural crystals’. Griffin is (so far) the only supplier known to have used this construction material, although sets exist in other forms of baked ceramic. These two are the only sets of the type known to Kjellman (as at 2014), so attribution to Griffin is made with some confidence. Neither marked with accession numbers, and intermingled in storage, two partial sets of pairs of crystal shapes survive. Comparing sets and text showed 107 of 125 possible models were represented. 77 appeared more than once, 21 remain to be matched to a sequence; a total of 218 models remain (Plate 6).

Richard and John Joseph were brothers; the family business, initially based in London where John Joseph was born in 1802, was bookselling (Gee, McConnell and Morrison-

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21 Registration ledger for the geological collections 1840-1841, and 1852-1853, held in the Natural Sciences department.
1. Sorting porcelain models associated with J J Griffin

2. Stands for crystal models

3. Corresponding Griffin catalogue entry [NMS Lib]
Low, 2014:270-305). The young John Joseph attended Glasgow’s Andersonian Institute, under Andrew Ure. Courses were available in Physical Philosophy, Mechanics for the Operative Artisan, and Chemistry; the last was immensely popular, attended by over 400, and Griffin excelled at it. At the University at the same time, Thomas Thomson set up a laboratory for practical instruction in chemistry, also spreading enthusiasm for chemical studies. With so many students, home experimenting was essential (Gee and Brock, 1991:32). Griffin wrote a manual for his fellow students entitled *Chemical Recreations*, published in September 1823 when he was aged 21. It sold out immediately, running to six editions in the next three years. Its straightforward and extremely accessible writing style matched other general works aimed at beginners in the mechanics’ class at the newly formed Mechanics’ Institute, Glasgow, to whom it was dedicated. Griffin produced a series of scientific works for practical people like himself, critiquing systems of mineralogy then in vogue, bringing ideas to British audiences, and avoiding the situation where ‘a person … could only obtain a tolerable stock of information by gathering together and by reading a great number of scarce, bulky and expensive volumes, to the great waste both of time and money’ (1827:iv).

To identify minerals from their properties, Griffin suggested using simple tests and equipment such as blowpipes, applied in a regular manner. Terminology for mineralogical systems was complex, referring to both chemical composition and mathematical descriptions (spherical trigonometry, solid geometry and three-dimensional analytical geometry all being required); simplification was his aim. He translated French and German texts, and travelled, enrolling in courses at the École Polytechnique in 1829 and Heidelberg in 1830 (Gee and Brock, 1991:39-40).

On return, he positioned himself as an informal teacher, analysing and re-synthesising techniques and knowledge. He participated in chemical debates, significantly at the Glasgow Philosophical Society and the British Association conference of 1841, the year he published *A System of Crystallography with its application to Mineralogy* and the accompanying model set (op.cit.:49-50).

Author, text, model and student were intended to work together to achieve understanding (the ANT translational effect), through the force the model and text exerted on the student. The models were intended to be hand-held (the correct way was illustrated) and Griffin introduced a series of simple symbols to describe crystal shapes. The first part of his book offered a ‘tolerably complete sketch of modern Crystallography’
He then demonstrated his notation applied to several systems, translating Gustav Rose’s catalogue of minerals giving crystal system and chemical compositions, and a catalogue of crystals matching minerals. The third section gave a systematic arrangement of natural crystals, listing the minerals commonly found in each form, and showing how to differentiate specimens. The last section described the crystal models to illustrate principles and mathematical, mineralogical and practical details. The models he regarded as:

indispensable [sic] for the comprehension of the science by every one [sic] who does not study it according to the strict rules of mathematics. It is perhaps possible for an accomplished geometer to learn the principles of crystallography without seeing either crystals or models; but the popular student need not attempt to learn the science without the aid to be derived from models of crystals, which afford that constant tangible correction of his erroneous ideas, which is indispensable to his progress and success (1841).

From about 1838, Griffin supplied equipment alongside scientific publishing, focused in London through the 1840s. He exhibited at the 1851 Great Exhibition, and was invited by Henry Moseley of the Committee of Council of the Department of Science and Art to recommend suitable apparatus for both training and elementary schools (Gee, McConnell and Morrison-Low:298). Apparatus supply became a very successful and long-lived business, with dedicated trade catalogues and advertising in Griffin publications.

Given the range of business with which Griffin was involved, it is unlikely he himself made crystal models; they were probably prepared elsewhere and bought in as required, as was cheap scientific apparatus. Griffin’s catalogues offered the models for many years, but the small number surviving suggests that few sets were sold. Certainly, few found their way to public repositories. The identities of the makers are unknown.

As an actor in the crystal models network, Griffin’s role was small; in the background story it is rather wider. Although others argued Griffin had little effect on the science of crystallography (his System of Mineralogy was not reprinted, and only two of his crystal model sets are known in museum collections), he must have been one of the best informed people in Britain and possibly Europe about developments in crystallography, mineralogy and chemistry. He believed fervently that science should be available to a far wider audience than merely scientists, campaigned vigorously for clarity of expression in all three subjects, and worked to bring accessible text books and apparatus to working men (and presumably literate, interested women). His greater

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22 The book is available both as print and on-line – p.xvii of the book, p.26 of the scan.
23 Griffin, 1841:xxvi; p. 34 of the scan (the on-line edition has a misprint xvi).
educational influence lay with publications and apparatus supplied to students, schools, exhibitions and museums where it could be seen, explained and even, on occasion, ordered.

**Other sets acquired during Jameson’s directorship**

The accession registers show a number of acquisitions in 1852-1853 – a set of 119 crystal models in polished iron arranged according to G Rose’s system, a set of glass models to demonstrate ‘the position of crystallographic axes in the monometric system’, a set of four glass models to demonstrate ‘the position of axes in Dr Leeson’s system’, and the second set of Griffin porcelain models. The physical absence of the two sets showing axes (intriguing though they might be) precludes their discussion here; the Griffin set was discussed in the previous section; the Rose set illuminates another set of questions about the museum and its practices (Plate 7).

There are 97 extant iron models, yet to be matched with any published Rose illustrations, and serially numbered with worn red enamel paint. Griffin knew the Roses. Gustav’s brother was Heinrich, rather better known as an analytical chemist; Griffin translated his 1829 text (Rose, 1831; Griffin, 1841, title page). As mentioned, Griffin’s own *System of Crystallography* of 1841 was based on Gustav Rose’s work. As the models described were to show the ‘most important natural crystals’, individual identification of model type may be possible by comparing iron models with porcelain ones, and with Griffin’s book holding the ANT relations in place.

Confusingly, the 1912 NMS catalogue suggests a set of iron models formerly owned by Professor Matthew Heddle, one of the curators, was donated by his son-in-law Alexander Thoms, St Andrews ([Shand], 1912:3), but only one set has been found in the museum’s current collections. A similar set of iron crystal models is held at the Science Museum, London, also lacking either a maker’s name or identification of individual models.

The final Jameson acquisition is ‘1854-1855 NH42 – Models of gems. 3 series. From Highley. Purchased. Ordered by Prof Jameson’. The first mention of Highley in the London trade directories comes in 1823, Highley and Son being booksellers in Fleet Street. The following year, Charles Highley appeared as a maker of improved paper and cardboard pill boxes, at 81 Paul St, Finsbury Square. Directories record Charles as a

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24 A strange number – one may have been missing.
25 Register, 1852-1853 NH18.
26 ScM Inv No 1982-1783.
Plate 7

1. Crystal models in iron

2. Crystal gem models in glass
printer from 1823 to 1825, when pill box manufacturing took over. Back in Fleet Street, Samuel Highley ran a medical library and bookshop from 174 Fleet Street and 21 Webb Street, Bermondsey; in 1834 he was also listed as a publisher. The combined business appeared until 1852 when the company name became Samuel Highley and Son, and from 1854 Samuel Highley Junior described himself as a medical bookseller, publisher and mineralogist, at 32 Fleet Street. In 1854 there were only five names listed as Mineralogists, one being the representative for the Australian Geographical and Mineralogical Survey office. The following year Highley’s description changed again, to ‘Medical and Scientific Bookseller, publisher and naturalist &c.’; the list of other mineralogists included J J Griffin, and the trade section for naturalists referred directory readers to ‘Bird and Beast stuffers’, of which there were 37, and also ‘Birds and Live Animals, Dealers in’, of which there were 41, with a special marking for those who dealt in gold and silver fish.27

The impression given is of a very niche trade, with diverse trading strands. The last mention of Highley’s business comes in 1857, suggesting it closed down or was taken over. One possible reason is suggested in archive correspondence in the Natural History Museum Library, between Jameson and the dealer August Krantz of Bonn between 1848 and 1852, concerning the purchase of specimens and the text they were intended to illustrate.28 On 25 August 1852 Highley was touting for business, at a period of major change and expansion in the history of the Museum:

A letter I understand was received at the College Museum during my indisposition from Mr Highley in which he offers to furnish collections of minerals for the museum, he having been informed that large additions were to be made to the Mineralogical and Geological Department of the University – and the same information seems to have reached Paris as I have a letter from your former assistant Mr Seaman to the same effect. It is quite true that large additions are to be made to the Mineralogical Dept of the Natural History Museum in the University but this/.../ is delayed for a short time until the new accommodation for this extension is provided, the temporary delay being owing to the change of Ministry. It is our intention that the whole of the additional collections are to be obtained from your establishment at Bonn, being perfectly satisfied in all our dealings with your House.

The NMS archives contain weekly and monthly Report Books for the running of the museum, showing Jameson dealt with both Krantz and Highley, Highley noted as Krantz’s agent. The first mention of Krantz is dated 1848,29 concerning delivery of specimens; the first of Highley was 29 January 1853, when he sent Jameson a catalogue of his mineralogical collections (‘and trust I may be favoured by your order

27 Trade directories were consulted at the Bishopsgate Institute Library, London.
28 Natural History Museum, London - M.MSS BOX JAM.
and recommendation’).30 This was not completely successful either; Krantz replied that Highley was not good at passing orders on, and requested Jameson to order direct from Bonn.31 However, the next Report Book shows Highley supplied casts of fossil plants and other material; for a while business continued.

Only one set of glass gem models has been found – so far.

**Crystal Models acquired after Jameson’s tenure**

No further acquisitions joined the crystal model actor-network for six decades after Jameson’s death; it is not obvious if already-owned models were used. The museum experienced massive expansion, absorbing collections of a wide range of material. However, in 1911, a gallery was installed devoted entirely to Crystallography. Dr S J Shand, head of the geological and mineralogical collections, aimed to prepare a collection of models and crystals, arranged simply for self-instruction, but sufficiently comprehensive for advanced study. Most of the specimens came from museum holdings; the models ‘were cast from a set of iron models presented to the museum by Mr Alexander Thoms’, mentioned above ([Shand] 1911:58). The castings were worked up and finished in the museum workshop, crystals and models being mounted on standard wooden bases. Currently, 86 iron models match nickel models from display, and four more match unmounted ones. So there were models made in 1912 or therabouts, copied from ones made in about 1840. Shapes of crystal types do not change, whichever system they represent (Plate 8).

Formal accession was not completed until 1917: ‘1917-5 The Crystallographic Collection, 1-264’. By then, the displays had been slightly rearranged. Initially, the mounts were marked with a scorched catalogue number; at accession, the ordinal number was added using white paint. The two sets of numbers differ, some bases having two scorched numbers showing a lively period of use and reuse, where shape/likeness was potentially more important than identity, and models probably being handled by people who knew what they were anyway. This did not include Shand, who by the end of 1912 had become Professor of Geology at Victoria College, Stellenbosch, South Africa. Invisible human actors worked closely with the collection, unnamed workshop technicians creating a copy set of nickel crystal models for a specific display. Within ten years some of these models were removed from active gallery use and stored.

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Plate 8

1. Iron models, nickel copies
2. Haüy models, Natural Sciences Dept.

3. Haüy model set (part), Science and Technology Dept.
4. Alabaster models co-located with it

5. Smithson card models
6. Smithson leaflet
This crystallographic activity was intensified by another gift from Thoms, registered in 1915: ‘1915.11 Geol. collection of Models to Illustrate L’Abbé Haüy’s *Traité de Crystallographie* (two vols and atlas/Mineralogie 4 vols and Atlas.) 888 models made in wood, most with Fr labels stuck on them. From Mr Alex Thoms, 7 Playfair Terrace, Fife.’ Again, identity of individual crystal models is difficult to determine, with missing or torn labels, idiosyncratic numbering, and incomplete register descriptions. The numbering system is undocumented; comparing models with plates gave pictorial references for many, but not all. The set has a variety of woods and finishes, either from choice at manufacture or subsequent conditions of display or handling – some models have pins through the central axis, similar to the mounts for the 1917 Crystallographic Collection.

The Natural Sciences Department holds a second Haüy set, in the museum’s possession for some decades, but loaned to another department. A dedicated cabinet contains nine drawers of divided compartments holding individual models. The ninth drawer contained another set of models in alabaster, designed by Haüy, but attributed to Lamboutin by Kjellman, and some larger disparate items which may be neither complete nor matching. Provenance is not fully documented, but it is believed to have belonged to Robert Ferguson, FRS, FRSE, FGS (1769-1840) of Raith, representing Haüy’s system of 1809 (Livingstone, 2003/2006). The set is in good order, and from its pristine condition seems never to have been much handled. It contains over 500 models; most labels give the mineral name and a figure number, with over 400 of the models uncontroversially matching engravings in the 1801 *Traité*. Remaining discrepancies include mismatched or unconvincing connections to engravings, skewed perspective of model shape compared to engravings, discrepancies between model and image (for example, only one end of the shape being shown) and incorrect numbers written on the label despite clearly matching engravings. It is very unlikely the set is complete. Apart from any other disappearances, 13 *baryte sulphate* models were noted as having been removed by ‘W.G.’ on a date which could be a year ending in ‘01’ or ‘07’ – which century is unclear.

Haüy published his treatises with models to match. The models were made by technicians working first in his laboratory, then as a semi-official spin-off business. The crystal models were hand-carved from medium density woods, able to take a cut without losing sharpness of edges, and in some cases clearly oriented to take advantage of the direction of the grain for maximum strength. Each set could take up to three years to make; as an expensive prestige purchase, there was a waiting list. W Saeijs studied

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Haüy’s models, and discovered more manufacturing details (2008:391), quoting correspondence between Haüy and Martinus van Marum, Director of the Boerhaave Museum in Leyden, Holland. Haüy explained ‘one woodworker could not make more than 6 models a day, using all his time’; a more complex one could take four or five days. No written description of the manufacturing method has been found. Saeijs deduced they used sketches, and notes of the angles between the faces. Both illustrator and maker would have needed goniometers (ibid.:388-389), an angle-measuring instrument invented by Arnould Carangeot while making clay crystal models for Romé de L’Isle (Burke,1966:70-71).

Wilson and Kjellman identified Haüy’s craftsmen, presumably from French archive sources (2015). The first was Claude Pleuvin (d. 1800), and his apprentice Journy (b. 1784). Journy continued with Pleuvin’s son as apprentice for five years; in 1808 Haüy’s final woodworker and master model maker Beloeuf took over (ibid.:269). Sets taking so long to complete, others such as Larkin could enter the business. By 1820 Larkin was supplying to other distributors, including Bate and Mawe in London, Clark in Dublin and Harris & Co. in ‘Hamburgh’ [sic] (ibid.:271).

The nickel models copied from Rose’s iron ones, the two large wooden Haüy sets and the smaller alabaster set accompanying one of the latter are all forms of model Jameson would have known. The iron ones were acquired during his tenure, and the Haüy sets would have been familiar although he did not own one. The date of the crystallography gallery, 1912, was key in the wider history of crystal studies, as the discovery of X-rays revealed the inner structure of crystals, which were represented in other ways. However, students need to begin with familiar material and the external shape of a crystal is still an important starting point. One starter set of crystal models in card was designed in the 1920s, not acquired for the collections until 1992, and not studied in any major way until I investigated it (Insley, 2017). (A second similar set has been found since.) Neither has any direct connection within the actor-network with Robert Jameson.

‘1992.12.5 Cardboard models by Smithson. Purchased from Mr Alistair Telford, 24 Mayfield Terrace, Edinburgh.’ An accompanying 1928 leaflet gave clues about the evolution of the models, bringing new potential human actors into the actor-network. Cut-out card models were assembled from 36 patterns (or ‘nets’) sold by Thomas Murby and Co. The designer Frank Smithson, Fellow of the Geological Society, acknowledged this supplemented a similar series drawn up by ‘the late J B Jordan’, mostly following the text of a book by his friend G M Davies, illustrated by Mrs Davies and published by
Murby. Encouraged by ANT theories, I tracked these descending references through mineralogical literature to the early 19th century; providing drawings for students or autodidacts to trace or copy to make their own models was more widespread and persistent through the 19th century than previously realised.

Authors of works cited included some of the most significant names in 19th century education. Warrington Smyth was the first lecturer on mining in the Royal School of Mines when it opened in 1851, and according to his obituary in Nature in 1890 was the greatest British authority on mining matters (Warrington Smyth, obituary). Jordan was curator and course teacher at the Museum of Practical Geology, London, and ready to prepare further editions of his text to meet demand. Murby was a specialist publisher, supporting the subject literature and, in the case of card models, producing patterns and selling them either as plans, as ‘nets,’ or as made-up sets (who actually did the assembly was unclear). Impecunious students could make models cheaply themselves. In ANT terms, the link between author/teacher and reader/student was indirect; they could be widely separated both spatially and temporally, but the connection and communication still held. Consequently, links in this part of the actor-network were wide indeed.

Some crystal models remain unidentified. The largest group consists of 87 wooden models, from up to three sets, numbering up to 60, and possibly continental European in origin. I have found one further reference to crystal models, ‘sent from Paris by M. Descloizeau’ in 1846;33 he visited the museum the previous year,34 but I cannot associate specific models with this acquisition. However, the number of remaining unknowns is much smaller than at the start.

The stored collection has been transferred into the new building; some models are displayed in the new Science Galleries opened in autumn 2016. Identifying and naming remaining unknown crystal models is currently beyond the scope of this research.

Wider context: crystal models and their makers

The timescales over which models were made and used are both extensive and variable, and so is the wider literature. Ideas about crystal shapes and the internal structure of matter started in the 17th century, with the earliest extant models dating from mid-18th century. The discovery of atomic structure in the early 19th century did not displace the need to master external forms of minerals; ‘atlases’ of diagrams were.

produced into the early 20\textsuperscript{th} century. By then, X-rays revealed internal structural regularities; new understanding brought different methods of visualising substances under study. However, pedagogy must start somewhere; still today a handful of idealised crystal models are used in school classes before moving on to ball-and-rod forms (for molecules). Even in 1962 an academic paper described making wooden shape replicas \textit{en masse} for undergraduates (Brebner and Tocher, 1962).

The museological problem posed by crystal models was two-fold – to identify them, and to discover their history and purpose. Textbook illustrations gave mineralogical identities, but not necessarily makers’ names. Crystal models are usually too small and too numerous to be individually signed. To clarify identities, comparing models with engraved illustrations was vital, specifically when books and models were produced together.\textsuperscript{36} Identifications still to be attributed include the set of iron models after Gustav Rose’s system; comparison with Griffin’s book and models may assist.

Dealers’ catalogues are useful when found. Krantz was a major supplier through the western world from the 1830s, as shown by archival material in London’s Natural History Museum Library;\textsuperscript{37} some Krantz catalogues are available on-line, through the website for the Virtual Museum of Mineralogy (Krantz, 2011). \textit{Mineralogical Record}, an American journal for mineralogical collectors, hosts the web-based bio-bibliography compiled by Curtis P Schuh, probably the finest listing of historical works in the science of mineralogy and crystallography outside institutional libraries, but never published in print (Schuh, 2019). Schuh worked mainly from other people’s reports; some information is not completely accurate. For instance, Schuh suggested that Haberle in 1805 produced what may be the first sets of cut-apart paper diagrams for 106 crystal forms which, when separated, folded and glued, provided physical models. Schuh failed to note that both Nicholas Steno in 1669 and Romé de l’Isle in 1772 published drawings of flattened-out patterns from which paper or card models could be made. A compilation page of illustrations in J Lima-de-Faria’s \textit{Historical Atlas of Crystallography} (1990:55) showed these were intended for making up, having side tabs for fixing the patterns with glue or paste (Plate 9.1). No particular attention was drawn to this feature by the author. Lima-de-Faria, writing for the International Union of Crystallography, used time-maps as a historical tool, focusing on the development of crystallography in its geometrical, physical and chemical aspects, and therefore not largely concerned with making models of crystal shapes; this illustration is the only place they occur. With this lack of emphasis

\textsuperscript{35} Jameson (1804, 1816, 1817), Haüy (1801), Löscher (1796, 1801), Griffin (1841).
\textsuperscript{36} Romé de l’Isle (1772) examples in the Science Museum collections; Griffin (1841).
\textsuperscript{37} M MSS Box JAM letters Jameson to Krantz.
Plate 9

1. Plate 9, showing tabs
2. Plate 1, showing crystal shapes
3. Volume, showing drawers
4. First (top) drawer
5. Models from first drawer, matched to print of plate 1
on the potential role of physical models in conceptualising science, the makers remained invisible. Romé de l'Isle's first work on crystallography followed several auction catalogues of mineralogical collections (Romé de l'Isle, 1772). Nine of the ten plates illustrate crystal shapes; Plates 4, 6, 7, 8 and 9 include plans for cut-out reconstruction of the crystal forms, and in his preface he remarked he had made models from clay of the types of crystal shapes for which he did not have actual specimens (ibid.:xiii); his engraver requested models of crystal shapes in order to prepare the plates (Schuh, 2007). John G Burke (1966), discussing the origins of crystallography, described Romé de l'Isle as ‘a somewhat tragic figure’, as despite his evident brilliance, hard work and international acclaim, he never achieved membership of the Royal Academy of Sciences, Paris, possibly because of his sharp academic attacks on influential luminaries where he disagreed with them; the honour went instead to Haüy (1966:62-63). Examples of Romé de l'Isle models can be found in the Science Museum38 and illustrated in Touret (2004:48).

Dr Lydie Touret, at the Écoles Supérieures des Mines in Paris, was inspired to work on crystal model history by the identification of a set of early Haüy models in Teyler’s Museum in Haarlem in 1981. There too the models had become unrecognised. Touret (2004) surveyed the use of crystal models in geometrical crystallography in France and Germany from about 1770 to 1820, covering the period of rivalry between Romé de l’Isle and Haüy and giving much greater visibility to the makers. Linnaeus had tried to classify minerals as he had plants and animals, and published drawings of projections for ideal crystals. Romé de l’Isle acknowledged Linnaeus in his 1772 work, but, Touret noted, went much further in including crystal models with his mineral descriptions. He and his assistants Carangeot, Lhermina and Swebach-Desfontaines mastered a technique of sculpting models in clay, having them baked in the porcelain stoves at Sèvres (ibid.:46).

Haüy chose fine-grained pear wood for his models, which was easier to work than terracotta. His workmen Gillot and Pleuvin took several years to master the technique, with Pleuvin’s son and assistant Journy carrying on when Pleuvin senior died. Initially based at the Museum d’Histoire Naturelle, Paris, where Haüy was Professor, they moved to a nearby workshop when it became a major full-time enterprise. From 1809 slightly larger scale models (a set surviving in Vienna) were made by Beloeuf, assisted by another amanuensis, J A H Lucas. Beloeuf was formally acknowledged by Haüy in 1813, as ‘living at the Museum’ where he ‘executes with the highest possible precision a

wide variety of wooden models of crystalline forms’ (ibid.:52). Touret described the purchase of the Teyler’s Museum set, delayed for three years to 1804 as the first set they were expecting went to Werner in Freiberg instead. The high cost and prestige nature of these sets contributed to the survival of archival information, incomplete though it still is, about the making of the models. Saeijs (Teyler’s Museum) used instruments of the same date to measure the models, and re-presented them in stereoscopic projection, comparing Haüy’s results with modern data using computer programmes. Many of the models were made precisely enough to identify the mineral accurately using modern crystallographic data, testimony to the skill of the 19th century makers (Saeijs, 2004).

The lead in crystallography passed to Germany after Haüy died in 1820. Weiss of Berlin translated most of Haüy’s writings, taking them further, identifying four of the modern systems of crystallography from Haüy’s rather obscure terminology (Touret, 2004:58). Werner’s interest in obtaining a set is intriguing; he had large sets of models made to his own system by his assistant Löscher, with examples surviving in London and Edinburgh. Jameson studied with Werner, but was back in Scotland by the time the Haüy set was delivered; Edinburgh acquired Haüy sets many decades later.

Only mentioning models in passing, Burke (1966) showed Haüy brought together hypotheses of crystalline structure and rational systems of crystal classification in a unified theory, explaining variations mathematically. Emphasis mid-19th century was on mathematical analysis of symmetries, determining a maximum of 230 space groups – the number of symmetrical ways of arranging points in space so the environment around each point is precisely the same as around any other point but not necessarily similarly oriented. Early 20th century X-ray diffraction analysis confirmed this (ibid.:6).

By the early 20th century, the number of forms of differently named crystals reached over 23,000 (Goldschmidt, 1913 [-1923]); X-ray diffraction and new ways of visualising (and drawing) the inner structure of matter led to a counter-movement away from using model crystals. John Evans, mineralogist at the Imperial Institute laboratory, expressed this forcefully, in his preface to Hints for Crystal Drawing, written by Margaret Reeks, teacher at Imperial College:

> The accurate representation of geometrical relations in three dimensions is always a matter of difficulty, and this is especially the case with the forms of crystals. The most obvious course is to resort to models, but these are troublesome to construct, and occupy considerable space, so that for all

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39 It is not clear from her references where Touret found her information, but it seems likely to have been institutional archives for the Museums involved.
practical purposes some method of representation in two dimensions, in other words a projection on a plane surface, such as a sheet of paper, must be employed (1908).

Different projections for drawing crystals also burgeoned at this time, encouraged particularly by S L Penfield (1905). But this was the time when the then Royal Scottish Museum gave crystallography its own gallery, describing specimens and freshly-made crystal models in the accompanying catalogue (Shand, 1912). Both gallery and catalogue were revised a few years later, possibly influenced by the acquisition of a Haüy set in 1915.40

Historians of crystal models tend to be museum curators or academics. The Science Museum holds crystal models in several departments; the Natural History Museum (NHM) also has a large collection of crystal models in the mineralogy department, described briefly by Tandy (1998). Johan Kjellman of Uppsala is building a global database of collections, having visited the Natural History Museum and the Science Museum in 2013 and NMS in 2014. The literature grows.

2.3 Architectural Models, St Paul’s Cathedral

Introduction

As a group, architectural models at St Paul’s Cathedral, London, can be seen as non-human actants in an actor-network extending from the 1670s to the present day, based within the Cathedral. Sir Christopher Wren (1632 - 1723), Oxford University professor of astronomy, was appointed by King Charles II to create the new Cathedral, and rather unusually supervised the entire build. Contemporary financial accounts mention eighty models, between the Great Fire of London in 1666 and declared completion in 1711, but few survive - most were regarded as extremely impermanent by their makers and users:

Three dimensional models were clearer than drawings; they could be made from odd ends of wood, and when no longer needed they could be burned to warm the office (Anon., 1991:45).

Fortunately, parts of the First Model, a baldachino model and a model of the West end portico rediscovered later41 survive alongside the Great Model of 1673, made to show the King how the new Cathedral might look. These form historically the most important sub-group within the model collection; another sub-group relates to 19th century proposals for decorations to ‘complete’ the Cathedral to Wren’s plan, and a third to

40 NMS 1915.11 – 888 pieces.
41 SPCAA/R/7 Surveyor’s Report 21 March 1870 – the model had turned up in the property of a descendant of the Clerk of Works of the time.
structural support work during the 1920s. Other individual models were made for specific purposes within the Cathedral, or acquired as gifts.

Using ANT, it is however possible to see strands connecting the people, the models and the influences between them as the Cathedral staff moved towards their final decisions. The models as actors fall into a number of subgroups; as a network node, the Surveyor of the Fabric (in Diagram 2, Penrose) performed a similar controlling role for access and supply of details as that of Jameson for crystals, but with less authority for model construction. Authority remained squarely with the Dean and Chapter, who in turn relied heavily on external consultants. Wren’s contribution predates the cathedral he built; documentation, an ANT immutable mobile, is dispersed, largely in archive sources and published journals; references are given here in footnotes (for readability). The actor-network consisted of the models, the makers, the references (which were widely dispersed), the Cathedral and Cathedral staff. The role of external architects in specifying the models was very much emphasised, giving the models identities, but the makers, however skilled, remained generally unnamed. Considerable influence for individual models was exerted by more human actors, external consultants and commentators; this set of models relied for visibility on exhibition, which for most of them was sporadic, short-duration, but occasionally very high profile.

Diagram 2
Records for St Paul's Cathedral

As the models at St Paul's were stored inaccessibly to non-staff visitors without considerable internal assistance, it was necessary to identify which ones there might be from documentary sources. Chasing the models’ stories become the most direct way to find which ones might still be extant. Vital to begin with were texts related to Cathedral history – a tercentenary history (Keene et al, 2004), two written at the time of the 1920s repairs (Barman, 1925; Harvey, 1925), and a paper by the Surveyor of the Fabrick, Mervyn Macartney (1914). Architectural writer William Harvey, discussing methods of preserving old buildings, gave a rationale for using models:

Who will believe calculations expressed in decimals of a ton, where the very functions of constructional members are a matter of controversy? … such a model should be made before anyone gets to work carving Wren’s design and increasing the degree of eccentricity of the load upon the piers. The model would be built up with alternative possibilities of action … And would be useful also in demonstrating the possible increased efficiency of the buttresses if strengthened with reinforcement at their base, or by an encircling and uniting cone, or by both these members as suggested … the use of models is distinctly worthwhile (1925:113).

Such a discussion model was commissioned in 1925.42

More recently, James W. P. Campbell (2007) described the building of the Cathedral, devoting a chapter to the preliminary models made for Wren. William and Robert Cleere started the First Model in autumn 1669, completing it in March 1670. Having been shown to King Charles II in Whitehall, it was returned in 1672; part still survives.43 Wren began drawings for another model large enough that ‘a Man might stand in it’. The Great Model, ordered in December 1672 and completed in December 1674,44 has its own huge archive and is arguably the most famous architectural model in the country (Plate 10). It has been extensively studied, notably by George Rome Innes (2002), lecturer and former model maker at London-based engineering and design company Ove Arup and Partners Ltd. The models were made by the Cleeres, their names being known, but not widely; the models are known as Wren models, and their purpose was avowedly to help conversations with the client.

The Great Model as an ANT actor has been surprisingly mobile. Being viewed but not accepted by King Charles II, It was installed in Cathedral premises to raise money, a

42 SPC 583.
43 SPC 360.
44 SPC 8851.
1. The Great Model of St Paul’s Cathedral, 1674 (from the Cathedral website)

2. Great Model, November 2015

3. Inside the Great Model
purpose continuing (although not continuously) to today. Its location within the Cathedral changed, requiring dismantling and reassembly, as the various spaces that could hold it were required for different purposes. It has been subject to loan requests, most recently to a 1991 exhibition at the Royal Academy. The specification for moving it is one of the more valuable archival records; dismantling takes two men about ten days. In 1973 librarian Robert Crayford and the then chief sculptor (un-named) surveyed the model together, producing a nine-sheet description outlining how the model fitted together. In the 1980s, the model had a rather hectic display career, during which the then master sculptor Tony Webb assembled a list of over 300 individual parts for the model; the time taken to move it was reduced as a result. The instructions are retained by operational staff, rather than in the Architectural Archive.

The model’s condition has caused concern at various times; in the 1860s the South Kensington Museum borrowed it, promising conservation as a deal sweetener (Rome Innes, 2002:74-77). Its current location is in the Trophy Room at Triforium level, where it stands on a hip-high plinth, allowing access below and into the model so people ‘can stand in it’; at times this inner space had its own electric lighting. The model has been far from immutable, as generations of admirers cared for it, worked on it, moved it, and paid to just look at it.

Keene et al (2004) covered 1400 years of history of the Cathedrals on the site in one magisterial volume; the repairs from 1925 to 1930 were mentioned briefly. However, useful chapters about late 19th century decoration schemes informed the back history of many of the models in the Model aisle. Macartney (1914) described some of the Cathedral repair requirements, increasingly pressing over the following decade, and culminating in a five-year programme of ‘reparations’ and at least two models. 45

Through the second half of the 19th century, the Surveyor of the Fabric was Francis Cranmer Penrose, a human node to that part of the actor-network representing the story of the decoration scheme. Details of his central work as Surveyor, his related architectural models and those of Burges, Stevens, Macartney and Allen are followed by a discussion of the visibility of the models, if not of their makers, and the wider context of architectural model making.

45 SPC 583: a section of the dome and its supports, and SPC 5375: part of a pier, for public display.
Francis Cranmer Penrose

On 16 March 1853 Penrose made his first report as Surveyor of the Fabric to the Dean and Chapter of St Paul’s Cathedral, having assisted the previous Surveyor, Charles Cockerell, who resigned in 1852; this marked the beginning of 45 years of service in the role. His report followed a Chapter resolution of 1848 that:

there shall be laid before the Commissioners the Surveyor’s Report approved by the Dean and Chapter giving a Statement of the works which are proposed to be done in and about the Cathedral in the ensuing twelve-month, and containing his estimate of the cost thereof.  

These reports outline the work expected, and indicate progress.

Penrose was a classical scholar, interested in archaeology, astronomy and mathematics, and known for several architectural works unrelated to the Cathedral; Surveyor of the Fabric was not a full-time post. Tellingly, his RIBA obituary in 1905 makes little mention of his time at the Cathedral, implying he was not treated particularly well (Crace, 1903). His Dictionary of National Biography (1912 supplement) entry suggested his main task was to complete the redecorations; the Surveyors’ Reports show the focus was maintenance.

In the second half of the 19th century there was a very real desire to ‘complete’ the Cathedral – at Wren’s death in 1723, its interior was mostly plain. Wren had intended to install mosaics, beginning between 1715 and 1719 by having Sir James Thornhill (1675/6–1734), painter of large-scale decorative schemes, paint the inner dome. Penrose arranged the cleaning/restoration of these paintings by E T Parris, who used an ingenious and rather fragile-looking support frame for the purpose. Cockerell had seen Parris work this way in the Colosseum in Regent’s Park in 1829 and suggested it for repairs to the dome painting. Then, it had been too expensive, despite avoiding using normal scaffolding.

Dean Milman also requested Penrose to initiate a public debate in London and beyond, fund-raising for the completion of the Cathedral. Penrose lectured at the RIBA (1852), using Wren’s drawings, details of the Great Model, and the biography written by Wren’s son, Parentalia, to show Wren’s intentions. For forty years thereafter, all decorative scheme proposals had the desideratum that they should follow Wren’s ideas. It might be expected that, as the resident architect, Penrose would be invited to carry out the work.

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46 SPCAA/R/1 Extracts from Reports to the Dean and Chapter.  
47 SPCAA/R is the archive section for reports from the Surveyor.  
48 Shown in Cathedral items- SPC Penrose Project nos 107, 258, 259 and 260.  
49 LMA CF89, reports of fabric repairs c1752-1885.
Instead, suggestions were invited; Penrose did submit his own concepts, but the Dean and Chapter did not accept them, in the face of intense public interest. Nevertheless, Penrose had to support other applicants, providing detailed measurements and drawings where necessary, and commenting on their suggestions. This must have been hugely disheartening.

One standard demand of the Surveyor was management of memorial services and monuments in the Cathedral, the first major one for Penrose being the Duke of Wellington’s funeral. His report in December 1852, on gas fittings used for the funeral, recommended they should not be retained; the 2100 burners burned 30 shillings worth of gas in two hours and were inconvenient, unsightly, and hazardous to the security of the building.\footnote{LMA CF89, 10 Dec 1852.} The funeral was a massive pageant for London,\footnote{A panorama album of the Procession was displayed for a day by the National Portrait Gallery, 18 June 2015.} with huge logistical problems for the Cathedral, from providing temporary scaffolding and seating for the congregation to accommodating the sarcophagus (a temporary one, replaced with one made of Cornish porphyry in 1858) and the extremely heavy funerary cart that carried it.\footnote{SPC 5378: paper model in Library holdings; RIBA PeF/1/1/8 memo by Penrose after conversation with Stevens, 1869.} Applicants for designing the monument were supplied with a plan and instructions.\footnote{SPC Penrose Project drawings #276, ‘Plan to accompany instructions to artists who intend to submit designs for the proposed monument to be erected in St Paul’s Cathedral London to the memory of his Grace FM Duke of Wellington’; this has archive number SPCAA/D/1/5/1, and the draughtsman was G Buckler (probably an official of the Office of Works); see RIBA PeF/1/1-2.} During the competition, Penrose met the sculptor Alfred Stevens, supporting his successful entry, but it was many years before the monument was finished.\footnote{Wellington died in 1852; the sarcophagus arrived in 1858. See SPC Penrose Project drawings #176, and others, up to #223; RIBA PeF/1/1-2 letter book and bundle 1858-1870.}

### Architectural models at the Cathedral

Whilst working towards a decorative scheme, architectural models were created as visual aids. Confusingly, architects called their overall designs models, without necessarily implying a 3D object. However, Penrose did produce, or arrange to have made, 3D models to support decoration schemes. The earliest mention yet found of the desirability of a model was in 1859, when opening up sightlines through the Cathedral focused attention on the apse and choir. An early study for the dome decoration Penrose prepared in 1856-7 may have involved a model.\footnote{SPCAA/D/1/14/1.} The Builder reported his 1859 lecture on work supporting the introduction of evening services; discussion about the apparent size of lettering around the dome was followed by the remark that ‘it would
require the utmost tact and skill, on the part of Mr Penrose, to produce a model of internal ornamentation that would harmonise with the exceeding gracefulness of the cathedral itself. A later transcription of the lecture mentioned models of a shaped reflector to assist the audibility of the speaker from the pulpit, and a baldachino over the communion table which probably dated from Wren’s time. If Penrose had a decoration model at this stage it was for private use only.

Funds raised in 1858 were spent by 1861, but as Dr Prestige, ‘late Canon and Treasurer of St Paul’s’, pointed out nearly a hundred years later, mainly on enlarging and improving the organ rather than the decoration (1955, pp.82-83). Dismantling the organ partially opened the central vista of the Cathedral, showing how magnificent it might be. Attendances soared, and by October 1863, there was clearly a feeling more was required. Penrose replied to a comment in The Builder that ‘St Paul’s needs colour and fine art’, saying:

No-one can feel more strongly than those engaged on the work, that what is done is poor and ineffective, if considered by itself; but this is not necessarily a fault in a work in its commencement. I beg, moreover, to assure you, that the most earnest desire is felt for colour and fine art, but such works need time and funds for their achievement.

Behind the scenes, things moved on. The Great Model was loaned to the South Kensington Museum in 1857, so mention in 1862 of ‘expenses incurred on the model’, reporting to the Committee of the works done towards completion, arguably refers to a new model being created in support of the work. This is the earliest reference yet found to Penrose having a model made and is completely unspecific as to its nature. In 1864 the first spandrel mosaic to Stevens’ design was installed under the dome, with a second in 1866. Hesitation about using artists with foreign names (Schnorr for stained glass windows, Triqueti for mosaics) was appeased on hearing they were both Protestants, with strong English connections. There was also a note of a promised model of the choir; this could be Penrose’s model of the apse of the choir, with Triqueti’s designs, exhibited at the Royal Academy in 1866, a Guildhall Library photograph being published in Keene (2004:251). Summer Exhibition catalogue entries mostly consisted

56 The Builder, 1859, 12 February, pp.112-113.
57 The Builder, 1859, 19 March, p.203-204, quoting Parentalia; SPC 344.
58 The Builder, 1863, 24 October, p.761.
59 SPCAA/R/7, Surveyor’s Report 19 March 1858.
60 SPC Library, Decorations Box 3 (cup B, shelf 5) MS dated 18 June 1862.
61 The Builder, 1864, 30 July, p.567.
63 The Builder, 1864, 19 March, p.211 and 8 April, pp.248-9.
64 Royal Academy Summer Exhibition, 1866, exhibit 801.
of one line giving number, artwork title, and artist’s name. Unusually, this model’s entry extended to two paragraphs, naming Penrose’s student Robert Whellock as the maker (Plate 11). Proposals for using stained glass in the windows were tested on ‘the large model of St Paul’s recently exhibited in the Royal Academy’, which must refer to the Penrose model as the Great Model was still at South Kensington.

Penrose’s comments on decoration scheme progress in the Surveyor’s Reports consisted of single sentences; the rest concerned roof leading, fire precautions, cleaning and heating arrangements, re-gilding the ball and cross (using scaffolding erected to support the lights for the marriage of the Prince of Wales) and on-going problems with the organ. None of these added to his personal visibility as an architect, so his enthusiasm and determination to participate and support the decoration work was understandable. Dean Milman died in 1868; in 1869 Penrose, asked by the City to move railings surrounding the Cathedral, suggested a better scheme, selling land for road-widening and using the proceeds to improve the West front and pedestrian access. This took until 1872 to finalise, the façade taking its present form in 1874.

Writing much later, Prestige was unimpressed with the achievements of the Milman Committee, remarking ‘it had abolished the western screen of the choir, shifted the organ to a thoroughly inconvenient position, bought another organ and planted it in another highly inconvenient position and applied some sporadic and inconsequent decoration; this accomplished, it rested from its labour’ (1955:111). Dean Gregory, Milman’s replacement, toured Italian Renaissance churches, including St Peter’s in Rome, in 1869, then reconvened the Committee, launching another public appeal at the Mansion House on 13 July 1870. The process continued to be complex, as Committee members had not considered quite how they intended to bring colour and splendour into the church. Debates about provision of visual focus for worship for large congregations were wide-ranging and public. Positioning the choir screen, organ and altar, with or without a baldachino and bearing in mind the need to accommodate large numbers of people, had to be resolved first. 14,000 guests attended the Thanksgiving service on 27 February 1872, for the recovery of the Prince of Wales from cholera.

65 The Builder, 1867, 9 March, p.166.
66 V&A B&W print no N2014 - Great Model in 1868.
801 A model of the apse of St. Paul's Cathedral, to the scale of one inch to the foot, representing the proposed embellishments. Designed by the surveyor of the fabric. The figures in the windows are after Professor Schnorr; those occurring in the mural decorations are, for the most part, after the Baron de Triqueti. The baldachino is restored from a mutilated model left by Sir Christopher Wren. *Executed by Robert P. Whellock, pupil of, and under the direction of F. C. Pearce.*

"The painting and gilding of the arches of the east end, over the communion table, were intended only to serve the present occasion till such time as materials could have been procured for a magnificent design of an altar, consisting of four pillars, wreathed, of the richest Greek marble, supporting a canopy, hemispherical, with proper decorations of architecture and sculpture, for which the respective drawings and a model were prepared."—*Parentalia,* note, p. 291.
The William Burges models

In 1870 the Cathedral’s Fine Art Committee, six experts under the Dean’s chairmanship, narrowly voted for William Burges as chief architect (ibid.:144). 67 He had been approached earlier, his diary noting on 26 July 1870, ‘Beresford Hope called on me about St Paul’s’, 68 and a letter from Penrose on 6 August offering him £105 (100 guineas) to prepare a scheme of Iconography. On 8 August Burges met Penrose at St Paul’s and ‘saw his old model of the apse’, 69 having previously and publicly expressed severe dislike of Wren’s decoration scheme (Mordaunt Crook, 1981:159). Again, Penrose, Surveyor of the Fabric, was not in overall command but had the contractual right to comment on Burges’s scheme, whilst providing such basics as structural drawings and detail measurements. Penrose and Burges both studied architecture with Edward Blore, but a decade apart; a renowned classicist, Penrose had originally been a neo-Gothic enthusiast.

Work continued behind the scenes. Whellock, promoted to assistant, noted in a drawing book ‘Commenced dome model Nov 9 1870’. 70 On 22 May 1871 Penrose gave a lecture On the Decoration of St Paul’s Cathedral, at the RIBA, donating a copy of Burges’s Iconography. 71 In July 1872, he submitted A Description of a Scheme for the internal Embellishment of St Paul’s to the Committee, 72 concentrating on four areas – the choir, apse and baldachino; the dome; the painted windows at the four arms of the cross; and the smaller dome at the west end of the nave. Mainly he used drawings, but for the baldachino, there was both an uncoloured model and a coloured perspective drawing ‘composed as far as it can be recovered, from an imperfect model and a short description in the Parentalia’. 73 A 1:24 dome model was exhibited ‘as yet finished only in respects the Cupola’, 74 and by a perspective drawing. His proposals were exhibited in the Chapter House; again, The Builder described them the following month (3 August 1872:600), noting drawings by Woodington, Brewer, and Michael. The first two were

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68 William Burges, Journal, RIBA, BUW/1/1 p.81; Beresford Hope was an author and Conservative MP, and president of the RIBA from 1865 to 1867.
69 Ibid.:83.
70 LMA, MS 21753.3 sketchbook, February 1870.
72 F C Penrose, Description, July 1872, in Scrapbook, St Paul’s Cathedral and the Interior Decoration, Vol II, collected by Thomas Chipperfield, 6 Amen Court, 1874-6, SPC Library.
73 SPC 8849: Baldachino
74 SPC 354; with four painted panels by Woodington fitting inside the model of the Dome; SPC 356, 357, 7895 and 7986.
artists working on Cathedral matters; Michael’s identity is unclear. Confusingly, a photograph exists of ‘the apse model as exhibited in the Chapter House in 1872’ (Keene, 2004:249). Although this model is not mentioned in Penrose’s 1872 Description, parts survive in the Cathedral collection. It may be that the base dates from 1866, supporting a revised version of the dome.

Meanwhile, Burges embarked on a tour to study Wren’s ideas. Several copies of his Iconography survive; the Cathedral also holds an album of coloured illustrations of the component parts and some of Burges’s drawings. Following recent historical studies, much of Burges’s archive is well-known, the Cathedral, RIBA and the V&A all having important holdings. His appointment was hugely controversial, and his ideas debated under glaring publicity. Multiple copies of reports and letters were printed, issued to the press and saved in scrapbooks. His plan was embodied in two coloured models at a scale of half an inch to a foot (1:24); the estimate was £400,000, ten times the funding available. The Fine Arts Committee inspected the first model, of a bay of the nave, on 7 December 1873, and the second, of the choir, on 27 March 1874. It rejected both, but was overruled by the Executive on 19 May 1874, which accepted the scheme and dissolved the Committee. Ex-members then retaliated through the press; the models being exhibited, the Daily Telegraph of 28 July 1874 remarked on an ‘inspection of the restricted and flimsy model exhibited at the Royal Academy’. The scheme was discussed in detail in the architectural press; the Dean and Chapter lost their nerve, suspending the project altogether in November 1874 (Plate 12).

Although contractually related models and drawings remained the property of the Dean and Chapter, Burges argued strongly for this in a letter to the Dean of 23 November 1874. He also attempted a final re-colouring of the models to accommodate comments from earlier in the year, to address some of the disadvantages he felt that the models experienced.

… I worked by means of models rather than by drawings because my experience told me that the work is done more thoroughly and the difficulties better foreseen by their use than by coloured drawings, where colour can be blended softened down and hidden by convenient shadows. My experience also told me that the colours in a working model require to be slightly more crude than in a picture as their intensity is very considerably altered by the accidents of position thus, a blue will require to be of a different intensity according as it may be placed on a floor, a wall or a ceiling. The Models which I have had the honour

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75 Album SPCAA/A/1; drawings SPCAA/D/4.
76 SPC Library, Scrapbook, St Paul’s Cathedral and the interior decoration, (2):41.
77 Anon, [but probably Burges], A description of Mr. Burges’ models for the adornment of St. Paul’s now exhibited at the Royal Academy, London, E Stanford, 1874; NAL Ref 2079-1879.
Plate 12

1. Report for the scheme of decoration
2. Album, showing colour schemes
3. The second model of choir and apse
4. Burges diary index entry for November 6, 1874 [NAL]
to bring before you have been designed for working purposes and thus the
colours are slightly more crude than the[sic] would appear on the building. By a
late resolution the Committee has devoted a certain sum for sundry drawings to
be made not only of the parts shewn in the model but of the whole scheme of
decoration. An opportunity will thus be afforded of ascertaining the probable
effect of the colour when actually applied to the building.

These drawings are now in course of execution and at the same time I am
engaged in revising and I hope improving the colour of the models. When
finished I would suggest that these models & drawings become definitely the
property of the Dean and Chapter and that the former be deposited under glass
in some accessible place in the cathedral itself.79

Despite notes of expenditure against preparation work for these models, detail is thin.
Burges had inspected Penrose’s apse model before embarking on his own; on receiving
the contract, he requested drawings and models.80 By June 1873, the nave bay model
was apparently under construction, as in July he was authorised to spend £100 on the
(second) apse model, defraying some excess expense on the first.81 Burges employed
one artist, Lonsdale,82 to colour his design, and regularly used another, Haig,83 to
produce watercolours of his schemes. Tellingly for this thesis, the model maker is
unnamed in either his notebooks or his journal, evidence for the different attitudes
Burges showed to acknowledged artists compared to an apprentice or artisan.

The models achieved publicity through their exhibition at both the Chapter House and
later at the Royal Academy, but remained unattributed. As suggested above, this might
have been a good thing; much of the comment was unfavourable, although directed at
the decoration rather than the structure (apart from the Daily Telegraph comment noted
above). Indeed, Building News explicitly stated:

In all the remarks which I have to make on the subject of this beautifully finished
model, I wish it to be clearly understood that they refer not to the design in the
abstract but to its suitableness for the decoration of St Paul’s Cathedral.84

No internal document I have yet found names the maker, in either Penrose’s reports to
the Dean and Chapter or supporting comments to the Fine Art Committee. However, in
an introductory essay to a V&A exhibition in 1973, John Physick made an unreferenced
remark that they had been created by Whellock, Penrose’s assistant (Physick and
Darby, 1973:13). This makes sense. Penrose, as Surveyor to the Fabric, ran an office
near the Cathedral, moving into the Chapter House itself early in his tenure. There is no

79 Burges, Journal, RIBA, BUW/1/1. pp. 240-244.
80 Burges, Journal, RIBA, p.137.
82 Named, but not otherwise known.
83 Axel Haig (1835–1921), prolific illustrator for the British Gothic revival.
84 Scrapbook assembled by E J Harding, LMA MS25809/2 Notes on Mr Burges’ model showing
the proposed decoration of a bay of the nave of St Paul’s Cathedral. (2 pt 1).
simple way to discover how his office was structured, who he employed, or indeed what work was done there. Whellock appears in the SPC Architectural Archive under his initials, his full name on drawings done under Penrose’s supervision, and occasionally as ‘Whillock’.\textsuperscript{85} He regularly engraved Penrose’s designs for \textit{The Builder}.\textsuperscript{86} The LMA holds a small number of his sketchbooks and notebooks, including one which details a truly appalling work accident he experienced at the end of 1877.\textsuperscript{87} This is not mentioned in the Surveyor Reports, despite his needing surgery, and being off work for several months. He later appears in the Minutes of the meetings of the Dean and Chapter, mainly for agreeing not to sue the Cathedral; the Chapter awarded him £100.\textsuperscript{88} It remains unclear where Physick found the information he might have been the model maker.\textsuperscript{89} I searched archive holdings for Burges, Penrose and Whellock, and found no direct evidence for this, although it does seem likely, with the 1866 Summer Exhibition entry being the source. Whellock’s subsequent anonymity may have been a policy move by Penrose, sparing his assistant from any opprobrium the models attracted. Whellock was deeply involved with making models from 1866,\textsuperscript{90} commenting on the Stevens model in 1882 (see below).

Burges’s two models were subsequently illustrated in \textit{The Architect} of in a trial of a new process for reproducing coloured photographs. This was successful to a degree;

\begin{quote}
from the nature of the work it was impossible to render it in line, as would be needed for ordinary photo-lithography ... In the case of the bay, the effect has been given fairly well; but as was inevitable, much of the detail of the models has been sacrificed (1879, 8 November:271).
\end{quote}

The article quoted the 1874 Sandford pamphlet; the images were two double page spreads inset in the volume, reproduced by Mordaunt Crook (1980, Plates XLVII, and XLVIII), coinciding with another V&amp;A exhibition. Burges argued unsuccessfully for a trial of his scheme in situ in June 1875, and again in April 1877.\textsuperscript{91} On 14 June 1877 the Dean wrote to him to confirm ‘the models and drawings will be taken good care of while he [the Dean] remains at St Paul’s’, their formal agreement being terminated the

\begin{footnotes}
\item[85] For example, Penrose Project #302, drawing dated 1890.
\item[86] For example, \textit{The Builder}, 1873, 23 August, p.666 details of organ, p.667 view of organ; 1875, 29 May pp.486-487 Choir School; 1875, 31 July, Wellington Monument (where he was acknowledged in the text).
\item[87] LMA CLC/514 MS 21754/2 notebook.
\item[88] \textit{Chapter Minute Book} 1874-1888, p.193.
\item[89] Physick died in 2004.
\item[90] LMA CLC/514 MS 21753/3, Sketch book (1870).
\item[91] Burges, \textit{Journal}:300.
\end{footnotes}
previous day.\textsuperscript{92} Only the apse model survives at the Cathedral;\textsuperscript{93} the destiny of the other is unknown.

**The Alfred Stevens Model**

A half dome model dated 1862\textsuperscript{94} is attributed to Italian-trained sculptor Alfred Stevens (1817-1875), best known for the Cathedral’s Wellington Monument – the maker’s name is unrecorded. A photograph showing it on two pairs of piers is captioned ‘Model of the dome worked on by Alfred Stevens between 1862 and his death in 1875 – a photograph taken before deterioration’ (Keene, 2004:247). The new Decoration Sub-Committee set up by the Dean in 1877 instantly acquired the model from the Stevens family. Papers relating to the decoration stated the model was designed in 1862, exhibited in 1872 and then put to one side,\textsuperscript{95} no other names being associated with the model’s construction (Plate 13).

This version of events is highly abbreviated. It may be the half dome is the dome model for which Penrose requested expenditure in 1862, in which case its ownership by Stevens is questionable. If exhibited in 1872 to the Chapter, it was not included in the accompanying description, not a lengthy document. However, Penrose and Stevens had a more complex business relationship than just via the Wellington Monument, as Stevens produced the first mosaic for a spandrel under the dome in 1864.

The dome model was acquired for £100, inspiring a collection of letters concerning whether the price was one hundred pounds or guineas, and who would pay for removal to the Cathedral.\textsuperscript{96} Sir Frederick Leighton (President of the Royal Academy) and E J Poynter, both familiar with Stevens’ work, were invited to complete the decoration to Stevens’s plan, and again ‘Mr Penrose will of course give all assistance to the selected artists and will prepare any architectural details such as drawings, etc.’\textsuperscript{97} In June 1879 arrangements were made for ‘A man to take the hemispherical part of the Stevens model of the Dome on Thursday mg. to E J Poynter, S Kensington Museum. Mem. It would go on the top of a four wheel cart and 2 men can lift it easily’.\textsuperscript{98} Leighton, Poynter and Hugh Stannus, Stevens’ assistant, worked together on schemes for mosaics. Penrose again was appointed to superintend their work, which included ‘1/6 cartoon in

\textsuperscript{92} Ibid.:308.
\textsuperscript{93} SPC 353.
\textsuperscript{94} SPC 350.
\textsuperscript{95} SPC Library, Box B/1 Cup W East shelf 11. Folder 4.
\textsuperscript{96} LMA, St Paul’s Cathedral CF 57 Ledger, *Correspondence with Artists 1877-1879*.
\textsuperscript{97} LMA CF57, ledger, p.13.
\textsuperscript{98} LMA MS25809/2: Scrapbook assembled by E J Harding, Clerk of Works 1873-1912, (2, pt 1).
1. Stevens Dome model

2. Whellock’s notes, 1882 (LMA)
plaster’.\textsuperscript{99} The plaster segments survive,\textsuperscript{100} along with full size paintings for in situ inspection, but these too were not accepted by the Decoration Committee.

Whellock made notes about this model in 1882 – ‘Mr Stevens’ Dome model some particulars Oct 25/[18]82. NB This model does not diminish ie is not part of a cone as in our model and as it is really in the actual Dome’.\textsuperscript{101} This implies there then were only two dome models, Stevens's and Penrose’s. There would also have been two apse models, by Penrose (and his team) and by Burges (and his), and another model of the bay of the nave by Burges (no longer extant). The dismantled Penrose models are inaccessible; clarifying which pieces are present is not currently feasible.

The congregation grew, the view into the quire and apse was opened up, and an altar and screen in white and coloured marble was commissioned from Bodley and Garner, installed in 1888. The accompanying mosaic scheme was awarded to William Blake Richmond, a specialist in monumental painting and Slade Professor of Art at Oxford. Richmond had discussed matters with Burges in 1874, and the design to go with the altar with Bodley. With two assistants, nineteen mosaicists and the advice of the Dean and Chapter, Richmond finally completed the scheme in 1904 (Zech, 2015). Penrose had retired in 1899, and died in 1903 (Crace, 1903).

At this point a useful summary of the more striking models (whether 3D or 2D) appeared in the \textit{Pall Mall Magazine}.

St Paul’s is full of discarded relics, out of which an interesting museum might be found. Foremost is the great wooden model which Wren himself made, showing his first idea of the Cathedral without a nave and without the side towers … fragments of Old St Paul’s … Poynter’s and Leighton cartoons … More interesting than these is the complete series of models, sections of a doll’s cathedral – showing at a small scale the architectural alterations and decoration for the interior proposed by a succession of artists … Stevens, spandrels by Salviati; Watts and Britten, Watts cartoon … a pair of very gorgeous ones submitted in competition by Mr Burges and Mr Penrose, with a series of paintings for the Dome … Sir Edward Poynter is the next model with paintings quarter and full scale and in competition with his a model by Mr Stannus. Last is the model showing Sir William Richmond’s scheme which was adopted.

These models are all most delicately and elaborately made, and painted in colours and gold, they show in some cases rich designs for a reredos which were never carried out, an erection on the baldachino pattern, recalling that of St Peter’s in Rome, with which St Paul’s is so often compared. It seems rather a waste to store these instructive relics in a lumber-room which is never traversed

\textsuperscript{99} LMA, MS 25809/1 one of three books belonging to Harding, spread 14.
\textsuperscript{100} SPC 369, plus cartoons 408, 769, 771, 772, 773, 774, 775, 776, 777, 794, 812, and 813.
\textsuperscript{101} LMA CLC/514, MS 21753/3 sketchbook, pp.120 -121.
except by workmen; and when the decorative work is completed, one may hope that they may be brought out and placed in some historical collection. 102

Artists are named, but not their craftsmen. Many items appear as drawings in the Architectural Archive; the list omits ‘a very fine model showing a suggested canopy to the Wren font’, noted by Mr Harding in 1879, 103 which is still in the collection. 104

**Reparations, early 20th century**

Another series of models, which could be seen as a related network, was made for the repair scheme for the dome supports between 1924 and 1930. Precision measurement of the building fabric over eighteen months investigated movement between winter and summer temperatures (Insley, 2016a). This Commission included experts from civil engineering rather than art; key to the process of debate and decision was the Surveyor of the Fabric, Mervyn Macartney, assisted and later succeeded by W Godfrey Allen.

The Commission’s Minute Book notes model making from autumn 1924. Discussion focussed on how the piers, main arches and superstructure supported the dome; Macartney referred to ‘a model which he was having made for this purpose. This model which was only partially finished was examined’ (Plate 14). 105

Once again, it is not immediately clear which model this is, as modelling began some time before viewing. A truly splendid model of constructional detail of the top part of a pier is known within the Cathedral as a ‘Macartney’ model. 106 The Architectural Archive contains two section views each of the pier and support, signed by Allen, 107 a half inch scale drawing for the construction of the model dated March 1924 signed by Keeble, with a tracing, 108 and two later drawings ‘for the model’ from August 1924, showing sections of structural cells ‘taken at front and back’ and a direct south elevation of four cells. 109 Macartney did not claim to make the model himself; exactly who did was unstated.

There is a simpler model of a take-it-apart nature, which may very possibly be an early version. It is formed by four building blocks placed one above the next, locked in

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102 Harding scrapbook, LMA MS 25809/2 pt 2:182: Marillier (nd but 1893-1904).
103 LMA MS 25809/1 Harding Scrapbook:19.
104 SPC 362.
105 SPCAA/SP/7/1/7 Minute Book of 1921 St Paul’s Commission, 6 October 1924, para.172.
106 SPC 5375.
107 SPC 7722, 7723, 7726, and 7855.
108 SPCAA/D/14/31 (1 and 2).
109 SPCAA/D/14/47(1 and 2).
1. Pier model, made by Allen for Macartney, on show, 1930 [SPCAA]

2. Pier model, stored

3 – 5. Peach model as built (1924), and on show in Trophy Room [SPCAA]

6. Peach model, stored
position by a peg-and-socket system. Very much within the skills of the Cathedral carpenters to create as a 3D aide memoire, it lacks documentation and provenance beyond being stored in the Cathedral.

In November Macartney informed Sir Aston Webb, the Commission Chairman;

As you are aware, I am having a model made to ½” scale to demonstrate thoroughly the complicated and delicate construction of the piers, main arches and superstructure. This is the first time any serious effort has been made to explain fully the construction of the vital parts of the building and I think when completed it will serve as a useful guide as to the best method of reconstructing the piers.

It is likely this refers to the more elaborate model.

But there is also a block model in wood, showing the church floor and the base of the dome, its earliest images dated 31 August 1926. What may be a reference to it as a discussion prop occurs in the Works Committee Report to the Representative Committee:

A number of methods have been considered, and the model, the construction of which was mentioned in the last report, has been found very helpful in the examination of the problem, the object being to provide for the transference of a greater proportion of the weight of the upper structure to the bastions in the eventuality of settlement taking place in any of the piers, in conjunction with the bracing and encircling of the drums envisaged in the summary of recommendations in the final report of the 1921-1925 Committee of Architects and Engineers (1927, January).

Although this too is known as a ‘Macartney’ model, inspiration to make it lay elsewhere. The expert panel included Captain Stanley Peach, RIBA representative on the Works Committee, and the Sub-Committee Minute Book records several mentions of a model made by Peach. On 3 December 1925 ‘the Resident Engineer [Col Sankey] and the Assistant Architect [Allen] were directed to visit Captain Peach to inspect the model of the cathedral.’ At the following meeting on 8 January, the Resident Engineer, who wrote the minutes, recommended the other members of the Sub-committee to see it for themselves. Peach promised to bring a portion of his ‘cardboard plan’ to the next meeting, and on 29 January, exhibited a plan of the platform level of the Cathedral, explaining proposed reinforcement methods. The Assistant Architect

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110 SPC 9185.
111 SPCAA/ SP/7/1/8. 24 November 1924.
112 SPCAA/ P/ 18/4 (1-5).
113 Peach designed the first Centre Court at Wimbledon.
114 Sub-Committee minute book (S-CMB) 1925-1930.
115 S-CMB, p.33, para.165.
116 S-CMB, p.35, para.179.
(unnamed, but Allen) was directed to have a model of this portion of the Cathedral
prepared, for the better elucidation of these proposals.  

The model was first mentioned on 26 July when its inspection was postponed; on 3
September the Sub-committee was shown photographs presumably taken in August,
and directed the Assistant Architect to indicate on the model the proposed position of
girders and other reinforcement.  

On 8 October, discussion with the model present led
to the Assistant Architect being directed to extend a portion of the model upwards to the
level of the colonnade, indicating where reinforcement would go, and on 8 December
the Committee made more suggestions whilst deferring more detailed examination.  

This is one of the clearest descriptions in the collection of using a model to aid
discussion. Its construction occurred when major decisions had in fact already been
made, not least because of a Dangerous Structure Notice delivered to the Dean and
Chapter on Christmas Eve 1924. The Cathedral was closed to everyone with immediate
effect until remedial works were completed. The solution involved retrofitting reinforced
concrete in the piers, two encircling steelwork chains round the dome, and other
supports. The piers were repeatedly drilled and filled with cement under pressure. When
no more could be inserted, one more hole was drilled and a steel tie bar of the same
diameter inserted and capped off. Beginning at the base of the piers in the crypt, the
work proceeded upwards, one pier at a time, with steelwork supporting the arches in
case anything went wrong (‘Saving St Paul's’, 2019; Insley, 2016a; [exhibition], 2019, 22
May).

This colossal undertaking continued until summer 1930, when the Cathedral opened
again with a Thanksgiving service, four new copes and hoods being made for the
occasion. A suggestion to display the models, largely promoted by Peach, was accepted, repeated the following year, for exhibition of models connected with the
preservation of the Cathedral in the Trophy Room. Timed to coincide with the
tercentenary of Wren’s birth, another exhibition was assembled in summer 1932, and

118 S-CMB, p.55, para.274.
119 S-CMB, p.59, para.294.
121 S-CMB, p.68, para.333.
122 SPCAA/R/13 Ledger of monthly reports by Surveyor of the Fabric to the Dean and Chapter,
p.22, 1930, 29 March; SPCAA/R/10 Macartney's final annual report, 1930, 22 November; and
SPCAA/R/13, p.36 1931, 28 February, a report on the exhibition.
123 SPCAA/R/11 1931, 21 November, p.5.
124 Anon.(1932), SPC Lib, cup W shelf 6.
toured to Birmingham and Manchester. The Trophy Room was redesigned in 1934 to become an exhibition venue, the surrounding area being opened up subsequently ‘preparatory to the formation there of the proposed Cathedral Museum’ and opened in the summer months from 1936 onwards. Once again, the story is slightly confused, with Peach’s offer of his model to the Cathedral being graciously accepted – whether this refers to the large block model or to another, possibly of cardboard, which failed to survive, remains unclear.

When Macartney retired, Allen became the next Surveyor of the Fabric, heroically organising the St Paul’s Watch to guard against fire and bomb damage during World War II, and managing repairs after two direct hits. The more damaging bomb exploded in the air between the choir and the church floor, blasting a hole into the Crypt, and blowing out the stained glass windows Penrose had such trouble to install. It also destroyed the Bodley Garner reredos and altar; Allen prepared a new design for the High Altar, reverting to Wren’s baldachino idea. He had the Burges apse model reworked and redecorated with Richmond’s mosaics scheme by Thorpe Modelmakers, the longest lived firm of architectural model makers in London.

In the 1950s, according to Martin Stancliffe, then Clerk of Works, the Cathedral authorities required a new Choir School (Keene, 2004:302). This replaced one designed by Penrose in 1875, a major task carried out for the Cathedral, but which did not appear in his Surveyor’s Reports, another example of separation of projects by both Penrose and Cathedral authorities. Once again the process was not handled well; the authorities asked Allen to design a new school, then decided to hold a semi-open architectural competition without telling him. Allen resigned in 1956, never to return to the Cathedral, despite having devoted nearly as much time to its service as Penrose the previous century. The winning choir school design by Architect Co-Partnership won an RIBA Award in 1962. Intriguingly, the competition rules specified models should NOT be submitted, only drawings and the brief, but why was unclear. Part of the new build

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125 SPCAA/R/15 1931, 28 February.
126 SPCAA/R/11, 1934, 1 December, p.6.
127 SPCAA/R/11, 1935, 7 December, p.4.
128 SPCAA/R/15 1931, 6 June, p.4.
129 SPCAA/R/16, 1949, 28 January p.3; Moon (2005) p.138; Thorpe’s archive is currently largely inaccessible.
130 The Builder, 1875, 29 May, pp.486-487.
131 SPCAA SP/16/4 Choir School Competition 1959-1962.
132 Architects Journal, 1962, 4 April, pp.714-726.
required consolidation of a war-damaged tower; a model was demanded and one duly made.\textsuperscript{133}

### Visibility

The models in the Cathedral collection have far more evidence of how they were used than the crystal models, although their makers remained obscure, largely because of the intense public interest in the problems of the iconic building they were designed to resolve. The makers' visibility remained problematic. Penrose served the Cathedral for nearly half a century, even though his employers appear to have consistently failed to make the most of his talents. He was a postholder for the RIBA for many years, winning its Gold Medal in 1883, and becoming President from 1894-6 (Crace, 1903). The citations barely mentioned his Cathedral work. Penrose’s assistants are even more invisible, but Whellock, having an unusual name, left a small archive trail and evidence of his Cathedral work in drawings and publications, albeit less acknowledged than it might be; his present visibility owes much to Physick’s 1970s so-far-unsourced remark.

The most obvious visibility for the models was by exhibition. As this is not usually a normal Cathedral function, some detail is given here. The Great Model drew the curious, and was a powerful money-earner for the Cathedral. Access and fees varied over the years, from near-mediaeval 18\textsuperscript{th} century ways to today’s polished front-of-house offer. The Great Model was placed in the Trophy Room (its present site again today) in 1710, was on display but in a poor condition in 1765 (Rome Innes, 2002:74-85); mentioned in guide books from 1816 to 1830; borrowed by the South Kensington Museum in 1857, where it was photographed in 1868. It did not appear in V&A guide books between 1869 and 1879. According to Robert Crayford it returned to the Cathedral by 1873 – ‘it was the determination of the Dean and Chapter that saved the Model for at this period a series of important architectural models in the care of the South Kensington Museum disappeared’ (Ibid.:78). Penrose suggested its conservation in 1891, to be done by in-house staff when no other work was required, and this was approved.\textsuperscript{134} In 1904 a visitor offered to contribute to the cost of conservation after seeing it in the Trophy Room (another example of an ANT actor exerting force).\textsuperscript{135} Macartney (1907) noted its presence at the west end of the Triforium, not having been on public display since 1870. In August 1929 it was installed on a new plinth in the Trophy Room after more restoration. During World War II the model left London, returning in 1946. From 1952 to 1961, it dominated a permanent exhibition including the Library, Library Aisle, the west

\textsuperscript{133} SPCAA /SP/16/31; SPC 592.
\textsuperscript{134} SPCAA/R/1 pp.26-27, p.2 of typescript of report.
\textsuperscript{135} SPCAA/R/1 1904, September, p.77.
end of the north Triforium and the Trophy Room (all at levels above the main floor). In 1982 a new display space called the Treasury was installed in the Crypt,\textsuperscript{136} from which the Great Model was loaned to the Royal Academy in summer 1991 (Anon., 1991). It was returned to the Trophy Aisle in 1993, and conserved again in 1996. A request was declined for it to feature in the massive show The Triumph of the Baroque, mounted in Venice, Montreal, Washington and Marseilles, from 1999 to 2000 (Millon, 1999). Huge but fragile, the Great Model is still displayed, a valued Cathedral property.

Schemes by Burges and Stevens also resulted in models with difficult and incomplete individual histories. Burges inspected Penrose’s apse model before embarking on his own, believing fervently that models communicated information effectively. Penrose offered a model of his own, possibly an earlier one re-worked. Both men being well known outside the Cathedral, debate was intense. The models appeared briefly in public view in Cathedral premises, or at Royal Academy exhibitions, with short labels naming the architects. Burges was also turned down; by the time the next Dean reconvened a Decoration Committee, he had died. Stevens’ model was moved to the South Kensington Museum for other artists preparing suggestions for the decoration to see, but again was not chosen for the final scheme.

Exhibitions of the collection of models were suggested, with the completion of the Richmond mosaics in 1904, and later by Surveyors of the Fabric attempting to organise suitable space to house the bulky but fragile models. The Pall Mall Magazine listing may indicate other 3D models were held in store by the time Richmond’s scheme was implemented (thesis:88). In addition, models may have remained the property of the artists rather than the Cathedral; models in drawings form may survive in the Cathedral Architectural Archive. Similar circumstances surround the models for the repair work of the 1920s, the expert committee debating how best to proceed. The models showed structure rather than decoration, informing discussions and indeed the final result. The work of the model makers was hinted at; ownership was not clear-cut, with Macartney carrying most responsibility, supported by Peach and Allen. Peach influenced greater visibility for the models if not their makers, through more lasting exhibition in the Cathedral and elsewhere; Allen’s first Surveyor’s Report in 1931 suggested ‘gathering models etc together and exhibiting them in the Trophy Room’.\textsuperscript{137} By 1937 the Cathedral Museum opened to the public during summer months.\textsuperscript{138}

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{136} SPCAA/P/10/2/1-5 Photos of Crypt Treasury.
\item \textsuperscript{137} SPCAA/R/16,1931, 21 November.
\item \textsuperscript{138} SPCAA/R/16,1937,10 December.
\end{itemize}
\end{footnotesize}
These exhibitions also gave visibility to models made by non-architects. A take-to-pieces model made in 1937 under Allen’s supervision elaborated the structure of the north portico.\textsuperscript{139} E J Bolwell produced a very high quality model of the upper part of the cone and the lantern,\textsuperscript{140} small and sturdy enough for exhibition in Washington in 1991. A stunning geological model prepared in the 1930s showed underground strata and water flows around the Cathedral, informing building works that might disturb the foundations.\textsuperscript{141} Two of the accompanying pit models featured in the 1932 exhibition of the tercentenary of Wren’s birth;\textsuperscript{142} a catalogue for another exhibition ‘designed to illustrate the history of the successive cathedrals dedicated to St Paul’s throughout the centuries’ (undated but post 1945) mentions nearly all the surviving models described here,\textsuperscript{143} except those acquired or created later.

\textbf{Wider context: architectural models and their makers}

My diorama work preceded architectural model research, but the latter followed naturally as modelled scenes may include buildings. The architectural model first attracting my attention at St Paul’s Cathedral was not primarily for public view, but to inform 1920s structural debate before major engineering work. Its first active life was over as soon as repairs began. Given the surprising number of architectural models held by the Cathedral, the question arose of where other collections of architectural models might be found, perhaps with more information about their histories.

Major national museums such as the British Museum and the V&A hold model buildings, focusing usually on the building rather than the model per se. RIBA also has a model collection, holding regular exhibitions of borrowed examination and competition models at its Portland Place, London, headquarters. The V&A uses architectural models in themed displays such as the British Galleries, has a curatorial team devoted to architectural history, and hosts a research room for overflow RIBA archives. Library catalogues are available on-line, and archive material can be seen by appointment. The

\begin{footnotesize}
\begin{enumerate}
\item[139] SPC 595; drawing in Architectural Archive signed ‘E J Bolwell Jan 1938’; SPCAA/R/11, 1938, 16 December, p. 2, Constructional model of north portico entablature, tying the portico to the main walls of the building.
\item[140] SPC 5374; completion noted in SPCAA/R/16, 1933, 2 December; RC24: photographed 19 June 1930.
\item[141] SPC 8384, and 9159 to 9184, the latter being individual models of pits dug to reveal the foundations’ structure. Accompanied by a Report (SPCAA/SP/22/1), a photographic album of plans marking the position of each pit, and photographs of the models when first completed (SPCAA/P15/2/1-37), and a set of coloured drawings showing the findings in each excavation (SPCAA/D/24/5(1-32)). The landscape model was delivered on 7 March 1934 (SPCAA/R/15).
\item[142] [Anon] (1932), exhibits 228, 229.
\item[143] Catalogue (nd) An exhibition designed to illustrate the history of the successive cathedrals dedicated to St Paul’s throughout the centuries, in the Library, Trophy Room and Galleries, SPC Library shelf 74.
\end{enumerate}
\end{footnotesize}
Royal Academy features architectural models in its annual Summer Exhibitions and architecture as a strand in its displays. Sir John Soane’s Museum, Holborn, houses his collection (both acquired items and of his own creation) in a building he designed as an architecture school.

Broadly, a model is made by or for the architect, and shown to the client. What happens thereafter depends on the intention behind the model; using examples from the Cathedral collection, these include private use for working out ideas (the ‘Macartney’ model of the pier and base of the dome),¹⁴⁴ winning the order from the client (the Great Model), and showing to a far wider audience over a much longer period of time (a use to which the Great Model was subsequently put). If the building is built, a model may be retained by architect or client (Peach’s block model remained his property at first, but was later accepted by the Cathedral, and indeed exhibited briefly in the 1930s). Over time, its relevance may decrease until it is withdrawn, or offered to a public institution such as a museum for continued preservation.

The history of model makers is an almost invisible part of the far wider history of the buildings they modelled, or of the architects responsible (sometimes the same people – architects frequently make their own models). Independent architectural model makers need a certain number of clients for sustainable business, making models their clients lack time, skill or both to create themselves (as happened with the model of Old St Paul’s by Partridges).¹⁴⁵ Trade directory research described in the next chapter showed that London (itself a geographical category changing over time) supported approximately 80 to 100 times as many architects as declared architectural modellers. From the 1830s onwards, RIBA publications – *The Builder*, *Architects Review* and so on – reported on contemporary issues, new designs and competitions, often with lavish illustrations and helpfully indexed, occasionally mentioning modellers. However, directly relevant literature is thin, dispersed, and occasionally very hard to find.

Architecture as a practice has long been aware of history in styles of building design, both in pre-existing buildings needing adaptation or conservation, and new builds. Architectural history is relatively new, a post-World War II field of study. The Society of Architectural Historians of Britain was founded in 1956, following the Society of Architectural Historians in Chicago in 1940. UCL claims on its website to be the first British university to appoint a Chair of Architecture (in 1841), with planning education being added to the course in 1914, and becoming multi-disciplinary in the 1960s.

¹⁴⁴ SPC 5375.
¹⁴⁵ SPC 559; (thesis:140).
Most literature on architectural model makers is written by journalists, architects, exhibition reviewers and historians of various kinds; articles featuring individual model makers do also appear from time to time (Covell, 1914; Gough, 1983; Seymour, 1985; Best, 1983; Armiger, 1995). A compilation by the *Architectural Journal* in 1985 featured Stephen Pfaendler, then managing director of Thorp Modelmakers Ltd. (Seymour, 1985). He started modelling with cardboard boxes as a child, and after art school worked on models for the morale-boosting 1942 film *In Which We Serve*. He authored an article for the *Architectural Review* in 1966, giving advice to his (presumably architect) readership on issues arising between architect and model maker. The 1985 article produced the interesting fact that Thorp had studied architecture with both Gilbert Scott and Edward Lutyens; it was no surprise that he restored Lutyens’ model of Liverpool’s Metropolitan Cathedral, as he was its maker.\(^{146}\) Thorp was also responsible for the large model of the Great Fire of London at the Museum of London, a *son-et-lumière* experience now upgraded to a multi-media show on permanent display.

The same 1985 article featured others. Kandor was a company set up by three former Thorp employees in 1983. They developed a reputation for inserting witty little features into their models, peopling them with figures doing all sorts of human things, and their work too is in the Museum of London. Tetra was a cooperative of five former students of the Architectural Association and an art school graduate, who by the time of writing had modelled several of Richard Rogers’ schemes. Having a good relationship with a successful architect helped ensure further work.

This point was emphasised further in another *Architectural Journal* article in 1990, which featured Presentation Unit (thesis:256) and their research work in developing computer numerical control milling and laser-cutting machines for sheet acrylic, an area in which they excelled, with Thorp and Piper. The article described the demands of a particularly important client, Olympia and York, then London’s biggest developer, with budgets to match. The company wanted four marketing suites world-wide to feature their developments for sale and rent, with identical high quality models in each suite, kept up-

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\(^{146}\) *Architectural Journal*, 1990, 7 November pp.30-31, ‘Model restoration’; made of yellow pine and cork, the model of the Metropolitan Cathedral of Christ the King, Liverpool is currently (2018) displayed at the Museum of Liverpool; illustrated in Moon (2005) p.94. Also in *Architectural Journal* 1985,18-25 December, p.31; the model was built in 1934, partially broken up for wartime firewood, and restored for an exhibition in 1975. Also Liggett (2000).
to-date. The contract was too big for a single company, but Presentation Unit partnered six other companies world-wide, and worked together to provide the very high-specification, high-quality models the client wanted (Rawson, 1990).

Writings by practitioners tend to be instruction manuals (Richardson, 1859; Janke, 1978; Pattinson, 1982; Blasche, 1824 and 1830; Grumbine, 1922; Nunn, 1942; Corbett, 1922; Hobbs, 1926; Aydelott, 1949), sometimes giving glimpses of model making practice. Take Edward W Hobbs. Moon cited his 1926 work, Picture House Modelling, in which he named Joyce Inall, a female modeller, suggested model making was a ‘task admirably suited to women’ (1926:x), and showed (off) a model made entirely from metal produced in the workshops of Twining Models (not his own workplace) (Moon, 2005:168). Moon hints but does not detail that Hobbs was an extremely experienced practical craftsman and marine engineer, becoming Bassett Lowke’s London showroom manager in 1908 and publishing prodigiously for hobby and autodidact markets, notably The Model Maker’s Workshop (1934), Pictorial House Modelling (1926), as mentioned, and House Modelling for Builders and Estate Agents (1937). Of further interest to me was his 1925 series Practical Architectural Modelling for the Architects Journal. He was quite clear about the function of models – ‘to enable the architect to place before his client a tangible representation of the contemplated work’. ‘The operations involved in making such models are few, simple, and usually well within the ability of junior clerks, lady tracers, and others’. The articles described techniques, tools and materials explicitly.

Part 4 considered high-grade commercial architectural models, ‘beyond the scope of the practising architect, and it would seldom be possible, or even desirable, to attempt their construction, except with the assistance of specialists. It featured a spectacular model constructed by Berthold Audsley, and presumably his team, of a section of a street to investigate different systems of electrical lighting. This involved special production of over 800 lamps, scaled-down in both physical size and illuminating

147 Works on model yachts, motor boats and steamers, furniture building, raffia work, veneering, concrete and wireless from 1925 onwards, with many editions being produced into the 1950s. Perhaps more significantly for the diorama section, he also published Scenic modelling (1930) and Model railway making (1934), the fifth edition of which was issued as late as 2013.
149 Ibid., Pt 1 p.543.
150 Ibid., Pt 2 p.692.
151 Ibid., pt 4, p.784.
intensity. When complete, it included fourteen lamp posts with three lamps each, forty-five different arrangements of lights, different colour schemes, and individual switches for the lights. The total cost of the model in 1926 was over £7000. Hobbs also discussed a model of part of a cathedral, and a tracery window, both to investigate the impressions to be achieved in the full-sized building.

Part 5 was devoted to the construction of the small fittings required to make a model complete—gutters, pipes, internal fixtures such as baths and so on. The description of moulding from plaster is described minutely, very probably the method used by crystal model makers working in ceramics and metal. The three case studies, crystal models, architectural models and dioramas, studied together, do illuminate each other, with similar manufacturing techniques common to all.

Model making as a tool for architecture does not have a large literature. Twentieth century writings, cited at the beginning of the twenty-first, usually emphasise two main purposes—working out design spatial and detail problems, and convincing the client (possibly through competition). Audsley, mentioned above, wrote in 1914 about the use of different scales for different purposes. He described simple block models at 4 or 8 ft to the inch (1:48 or 1:96—roughly 1:50 and 1:100) to give proportion and position of buildings with respect to each other and the site, a model of an industrial works at 16 ft to the inch (1:192) demonstrating a lighting scheme, and an extremely detailed model at ¼ ft to the inch (1:3) of an estate from which the parts required for a garden railway, itself at 15 inch gauge, could be ordered directly.

Rook’s instructional article (1918) appeared alongside an unattributed remark germane to the destiny for many architectural models, that many are found in architectural offices, but after their main use ‘are set aside in some obscure place, and finally become so shabby, through abuse and neglect, that they are broken up and thrown away’. The writer argued for preservation and exhibition of such models, including modern work.

Hirons (1920) described an iterative process of preparing working drawings for modellers, with the first drafts being eighth or quarter inch scale (1:98 or 1:48), for models to be made at 1:48 or 1:24. More details were considered at larger sizes, before a life-size model of decoration was passed to the stonemason for direct copying.

Gautier (1926) suggested that models at each stage should be moulded and cast in

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152 Moon (2005) cited a handful, of which I could check only one at the RIBA library - Boring (1922); the others (not given in the Bibliography) were McDonnell (1915), Waring (1989), Swartout (1911), Hetherington (1922), Covell (1922), Chisholm (1969).

153 Audsley (1914), p.216, and four photographs, figs IV to VII. Shown in plate 27.

plaster, with several copies being made at a time, one retained for reference while the others were used to show alternative treatments. Aydelott (1949) recommended a scale of 1/8 inch to a foot (1:96 or nearly 1:100) as best for representing a single residence.

Gough (1983), reviewing an exhibition at London’s Institute for Contemporary Arts for the *Architectural Journal*, remarked, partly in jest, that architects could keep their spirits up by producing beautiful models while they waited for opportunities to build the real things.

In summary then, the models were used to demonstrate – the look of a new building (Great Model), the distribution of weight (Macartney) and possible redecorations (Burges, etc). The force they exerted within the actor-network was insufficient to ensure the makers’ names were known. Even skilled architects such as Penrose and Allen were treated dismissively; assistants such as Whellock were even less visible, being un- or mis-named. The influence of Wren’s concept (which itself could be regarded as an ANT actor) remained until the early 20th century. Models too had longer lives than their makers, although not all survived, and some were reworked (Penrose and Burges's), being used as active tools, confusing their actual identities still further. There is evidence of enthusiasm to see the models, from those prepared to pay to see the Great Model throughout its active lives, or indeed to view exhibitions staged from time to time as decisions about the cathedral building were debated and resolved.

### 2.4 Dioramas, Science Museum, London

**Introduction**

The word ‘diorama’ has various definitions, not all used consistently. In museums, it signifies a representation of a scene containing 3D figures, viewed through a frame or aperture, with controlled lighting effects. The illusion aims to convince the viewer of the veracity of the setting, compared to specimens or figures shown within. Modelled perspective can be true, with uniform scale relations between components, or skewed, with near figures larger than figures intended to appear farther away, to imply distance. A plan layout would be suitable for a railway or a battlefield; the pieces are the same scale and can be moved around. A painted box might contain a primary figure with true perspective, with the sides, top, back and base painted or modelled to create the scene. Doll’s houses contain components and surroundings to the same scale and with true perspective. Skewed perspective dioramas merge a 3D foreground and base as inconspicuously as possible into a surrounding 2D backboard, and components too may be modelled with skewed perspective to fit the scene. Composite styles can give a
sense of a scene rather than a totally modelled one, for instance as part of a larger display.

The diorama’s origins come from public spectacle. Daguerre introduced a theatrical experience he called the *Diorama* in Paris in 1822 (Altick, 1978:163-167). The audience sat on a turntable, facing a modelled scene; a show lasting about 15 minutes had changing sounds and lighting effects on semi-transparent screens. The seating turntable rotated during a short interval to face another stage set at an angle to the first, for a second show.\textsuperscript{155} Visually, precedents lie with the *Eidophusikon* of Phillippe de Loutherbourg of the Paris Opera, in 1784. A seated audience in a darkened space faced a small proscenium stage. The show comprised clever mechanical and lighting effects controlled by unseen manipulators using pulleys and rackwork. So for instance storm-tossed ships could sway across the front of the stage, and then be seen smaller and further away, sailing in the other direction (Altick, 1978:121-127). Museum dioramas use the controlled viewing position and the brightly lit otherworldliness of the scene beyond the viewing frame, but are mostly static; to be convincing requires great skill, and Roussel excelled at it.

Makers of models have two peaks of visibility, first when selected to make the model in question, and second when they hand it over to fulfil its intended purpose. The first tranche of Science Museum dioramas were made directly because of the impact of dioramas at the Imperial Institute next door; for the Institute, discovering the artists was more complicated, and is detailed below. At the moment of gallery installation, the artists were recognised by curators, management, accounts staff, workshop and maintenance technicians and cleaners. Most of these people were at operational levels rarely appearing in official histories; despite their importance in keeping the Museum open and the work flowing, they too are largely invisible.

Overcoming invisibility is necessary for artists to attract commissions; here attention was by being appreciated in prior display. During production, invisibility is possibly an advantage, allowing the artist to work without interruption. Handover is important as a moment of recognition – satisfied client, fee (or the last part of it) paid, an opening event celebrating the exhibition as a whole, dioramas being part. Then the institution settled into a regimen of use of the new facilities, the artist turned to the next job, or to finding one, and official forgetting began, the artist’s identity no longer vital to the exhibition’s success.

\textsuperscript{155} Constable was unimpressed (thesis:42).
The chief diorama artist Raphael Roussel was acutely aware of this, and used his contracts to enforce and extend the acknowledgement he felt was due to the model makers (thesis:108). It is not known if he did this for either the first exhibition where his work was formally acknowledged, or the next, more institutionalised environment he negotiated for himself and his group. However, it was applied in at least two South Kensington museums for which the group worked, and maintained institutional memory of their output.

The Deutsches Museum’s 2016 book, *Szenerien und Illusion*, includes a chapter of mine on the Science Museum dioramas, with a brief introduction to the history of diorama as spectacle, the work of the diorama artists at the British Empire Exhibition, Wembley, in the 1920s, and at other London institutions (Insley, 2016b). Here, the component actors are regarded within ANT, focusing on their connections and influences.

Through ANT, dioramas are seen in a network including their makers, the commissioning curators, the various institutions that owned them, and the exhibitions for which they were intended. Again, references to source material are given in footnotes. A diagram of institutional links will be given after each institution’s story; the ANT process for a single diorama is similar to those shown for previous model types.

**British Empire Exhibition, Wembley, 1924-6**

The British Empire Exhibition, Wembley, was where many of the artists who made the Science Museum’s dioramas first came into contact with each other. The Government Pavilion housed exhibits from several departments (Anon., 1924); the armed forces sections showed models used in planning tactics, briefings and discussions of battles in land, sea and air. Herbert Henry Cawood was the Chief Modeller for the Pavilion, and Tom Ivester Lloyd the Military Artist. Both had been serving soldiers, Cawood in the Machine Gunners Corps (‘Herbert Henry Cawood’, 2011), Ivester Lloyd in the Remount Service (‘Tom Ivester Lloyd’, 2016). On the medical side, S H Daukes of the Wellcome Institute set up a section dealing with tropical diseases (Anon., 1924:75-77), Wellcome’s museums having opened in 1913 and 1914 (Anon., 1926). It is unclear whether he too was a former serviceman. Wembley had notably bumpy access roads – the artists on site checked models on delivery, repairing them if necessary.\(^\text{156}\) They would have met while setting up and dismantling their exhibits.

\(^{156}\) Imperial War Museum: EN1/1/BOA/5 20 May 1924 Reference to damage and repairs by Cawood.
Cawood and Ivester Lloyd were named in the accompanying catalogue, but despite this visibility how they were chosen or what work each did on models displayed is unknown. Similarly, Raphael Roussel, having fought in the Sudan and elsewhere before being imprisoned at Mainz (Waugh, 1919), may have made the model village for the East African Pavilion. Many of Roussel’s paintings, a travel poster now in the collections of the V&A and a diorama at the Royal Scottish Museum (now NMS) feature scenes from East African life.\textsuperscript{157} Without evidence about how the artists came to Wembley, I conclude it was the first time their work was shown together.

The Imperial Institute

The models’ popularity caught the eye of the second significant institutional user of their art, Sir William Furse, newly-appointed Director of the Imperial Institute and keen to make his exhibition galleries more appealing (Furse, 1930). After Wembley was over, he found the artists and persuaded them to join him; the nature of the negotiation is unknown, but it must have taken place. A dedicated studio under Roussel produced purpose-built dioramas at the Institute, and the popularity of the diorama form began to soar. So Wembley models, as ANT actors, exerted force, influenced Furse and inspired major institutional change (Plate 15).

In joining the Institute, in an ANT translation, the artists too were affected, exchanging a level of independence (with accompanying uncertainty) for security, dedicated facilities and relatively steady work procured on their behalf. Their independence was not completely sacrificed; they could and did work for other clients. Both at the Institute and elsewhere, they worked together; how Roussel emerged as leader is also unclear. Cawood joined the group, but Ivester Lloyd did not, possibly because he lived outside London. The others were Montague Black, Herbert J Rooke and Ernest Whatley.

Furse lectured at the 1929 Museums Association Conference about the Imperial Institute’s ‘panoramas’ (he used the terms ‘diorama’ and ‘panorama’ interchangeably), the studio having operated for three years. He described the work as a mixture of sculpting and painting, remarking ‘its satisfactory illusion can only be conveyed by a real

1. Postcard of South Kensington, 1907

2. Making dioramas at the Imperial Institute, 1929 [NHM Lib, Mus J]

3. The first diorama gallery at the Imperial Institute, 1929 [NHM Lib, Mus J]
artist thoroughly experienced in this type of work’ (Furse, 1930:337). Although he omitted to name the artists, *The Times* did, publishing regular reports on Institute work before the galleries even opened. Its first article on dioramas was published on 6 July 1926;\(^{158}\) in January 1927 the Prince of Wales visited as Patron of the Institute and gave permission for a diorama to be made of his own ranch in Alberta.\(^{159}\) Created from photographs, the final effect unveiled in February 1928 met with his delighted approval. All five artists worked on the model, and were named in the newspaper.\(^{160}\)

Furse regarded himself as being ‘fortunate in having five of these artists which I have kept busy during the last three years’. He respected their work, to a degree depending on it for the new success of his institution. They were trained – Roussel by his father Theodore and Innes Fripp (Whatman, 1959), Cawood at the Sheffield Technical School of Art and the Royal Academy Schools, where he won a silver medal, collecting it the day before joining the Machine Gunners Corps in 1916 (*International Studio*, 1916 (58):72-3). Rooke attended the Royal School of Art and the London Slade School of Art.\(^{161}\) Black’s and Whatley’s training have yet to be clarified, but both designed posters for travel companies – Black is particularly renowned for work for the London Underground Group, formed by Frank Pick in 1908 (Cole and Durack,1992). Roussel and Rooke also produced posters (Cawood apparently did not); all of them were illustrators. They were multi-talented, able to make a living by their art, so the offer to work at the Institute would have had to be made attractive to them.

Why Furse failed to name them – rendered them invisible – is unclear. All the models in this thesis were parts of something bigger, in this case, exhibitions. An exhibition may have been greatly enhanced by their presence, but they themselves were not the end result, the exhibition was. Another possibility may be that Furse was a Lieutenant Colonel, outranking the group of former soldiers. Alternatively, although he respected their skills, he none-the-less still saw them as artisanal craftsmen, without differentiating layers of professionalism within the studio. *The Times* did name them, possibly reflecting a somewhat more arts-based background for the journalist responsible for the stories, and appreciation of human aspects behind the story of the day.

\(^{158}\) *The Times*, 6 Jul 1926; p14; issue 44316; col E ‘Dioramas of the Empire. Imperial Institute Exhibition’.

\(^{159}\) *The Times*, 13 Jan 1927; p14; issue 44478; col C ‘The Prince at Imperial Institute. An Informal Visit’.

\(^{160}\) *The Times*, 17 Feb 1928; p20; issue 44819; col B ‘The Prince’s Ranch. Canadian Diorama for the Imperial Institute’.

Impact

The Imperial Institute was closed for preparation of new displays from 1925 to September 1926. Furse reported visitor statistics for 1924 before the closure, of about 5,000 schoolchildren per year. The first year after reorganisation was 1927, with over 40,000 schoolchildren counted in their classes; in 1928 the number doubled again to 80,000. The total number of visitors for both galleries and cinema for 1927 and 1928 was 787,000 (Furse, 1930:340). Numbers surged with each new set of exhibits; the *Museums Journal*, noting the Institute’s Annual Report for 1929, suggested:

> The extent to which panoramas, transparencies and models are used in the various courts and the effective results of the display are matters which might well engage the attention of many provincial museum committees to say nothing of the various other national museums in the South Kensington district.\(^{162}\)

As an example of the ANT postulation that assemblages of actors can exert force, the combination of director, artists and dioramas resulted in a visitor attraction that was numerically at least very successful. Within the Institute too, the effect was noted; each country had a display area or ‘court’ for contents chosen by its government, usually through its High Commission. New Zealand’s court featured the first six Institute dioramas, in September 1926, with notable success; other governments began to lobby for their own areas to receive similar improvements.\(^{163}\)

Themes chosen for dioramas included settings from which the country’s products came and the variety of industries across the Empire. The Institute was partially funded by the Board of Trade, and temporary loans to trade fairs of exhibits including dioramas were arranged; despite their size and fragility, dioramas were surprisingly mobile. The pattern used to make them was sturdy enough to permit this – the scenes were fitted in internally-wired dedicated cases, moved around as required (McLintock, 1936:93, plates vi and vii). The dioramas were ‘immutable mobiles’ in ANT terms; once created, they could be installed, moved, loaned out, withdrawn or, if desired, updated. Their audiences were thus widened, to an undocumented extent.

South Kensington – Science Museum

By the end of the 1920s, the numbers of people flowing up Exhibition Road to see the Imperial Institute’s dioramas were noticed by the Science Museum and other London institutions. Roussel was approached by both the Science Museum and the (then) Museum of Practical Geology, newly built next to the Science Museum; both

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\(^{163}\) Ibid.
commissioned dioramas.\textsuperscript{164} The Science Museum’s Introductory Gallery opened first, with eight dioramas and more promised; the artists worked at the Institute, but had workshops at home or elsewhere from which these new orders were collected. They shared the work; a model commissioned from one might be collected from another’s studio, causing mild confusion over who should be paid (Plate 16).

The Science Museum’s documentation includes files of correspondence with individuals, and technical files relating to each item accessioned into the collection. Accession numbers have the form ‘[year] hyphen [number of acquisition that year]”; technical files have the prefix T and the accession or inventory number. The story given here is compiled from the many files covering the dioramas in the museum’s collection. At the moment of production, the artists were not anonymous, signing their work, and being individually paid. They liaised with the curators, even more anonymous to future visitors, but controlling and influencing exhibition content behind the scenes.

Relations between curators and artists, particularly Roussel, could develop into friendship – one of the curators, Frederick Hartley, took up painting on retirement, going to Roussel’s studio to do it. However, if orders ran late, management called the shots, pressuring the curators to get the work finished, in extreme cases by someone else. Whilst writing this section, it dawned on me that in my enthusiasm for enhancing the roles played by the artists for Szenerien und Illusion (Insley, 2016b), I completely neglected the managers’ role in the story.

Roussel as leader of the group was sensitive to possibly being rendered invisible. In contracts at both museums he specified the artist’s name should appear on any label, description, photographic caption and any reproduction of the image such as postcards, a vital factor in ensuring visibility for the artists. This practice continued from the 1930s into the 1960s, by which time there was a new generation of curators, designers and artists in place; naming names continued. However, the level of personal knowledge declined, association with a named individual was the same as for any maker of an artefact within the museum’s collections (allowing me to recover the information), but of subsidiary interest to gallery content.

Although it would be obvious to the various institutions that the artists worked for them all, it is not mentioned in their respective archives. Indeed, when Roussel was particularly late delivering a Science Museum diorama, the official file attributed this to

\textsuperscript{164} ScM Nominal File 5406 \textit{R T Roussel}; McLintock (1936).
Plate 16

1. Science Museum Children’s gallery 1931 [ScM image]

2. Postcard, first ScM diorama

3. The first diorama, stored
his high quality workmanship; however, files for the Museum of Practical Geology show he had delivered one to them the previous week. Imperial Institute official papers are in the National Archives at Kew; press announcements of new dioramas show that the Institute studio was kept remarkably busy during the 1930s, over a hundred dioramas featuring in *The Times* and the *Illustrated London News*.

Institution to institution, as I show in following sections, the Imperial Institute influenced the Science Museum and the Museum of Practical Geology. The artists serviced them all. Within the Science Museum, the main human actor initially was Frederick St A Hartley, Assistant Keeper (a curatorial position) and Secretary to the Advisory Council (a managerial one). He and three other curators planned the new introductory gallery, Hartley steering it through funding and implementation. Sir David Follett (Science Museum Director from 1960 to 1973) noted in his 1978 history of the museum that the Children’s Gallery, as it rapidly became known, was Hartley's chief personal interest until retirement, his most outstanding contribution to the Museum's development and probably its best known single feature (Follett, 1978:114). For the first couple of decades of diorama display, Hartley acted as a node in ANT – all information, contacts, agreements and permissions for payment passed through his hands. Roussel was the only diorama artist named by Follett, who remarked he had ‘made a name as a pioneer of this form of display’ (Ibid.:115); that Roussel was seen as an originator is an important point to which I return (thesis:173, 213). The others remained invisible.

Hartley, writing Roussel’s obituary, recalled the work starting in 1926, shortly after the Imperial Institute studio began to make its mark. Follett, writing about a time of which he had no personal experience, recalled it as 1929. The Children’s Gallery dioramas were made to a formula, each sliding into position behind window-like glass, with dust-proof surrounds. The visitor’s impression was a series of brightly lit windows, slightly smaller than the actual sizes of the dioramas, encouraging viewers to peer in. As with the Imperial Institute, the exhibition contained other exhibits, both static and interactive ones for visitors to manipulate. Push-buttons and other mechanisms were used on other galleries, being notably popular with schoolchildren. Associated pedagogy was debated at the time and later; Anna Bunney (2010) connected it with the ‘Science for All’ movement which argued that history and context helped make science more understandable, and humanised it. The gallery was undoubtedly popular, with similarly

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166 My thanks go to Dr Tom Wilson of the Design Museum, for alerting me to this.
167 Both newspapers were available on-line to the author at the Science Museum, licensed by the Science Museum Library.
increasing visitor figures post-opening as at the Imperial Institute, and dioramas memorable as part of the display (Ibid.:203-204).

Diorama appeal extended to non-technical adult visitors, and the history/realism combination gradually spread to other areas of the museum. Ghislaine Lawrence noted increased pictorialisation in the late 1920s, using retail window dressing and shop display techniques. Painted backboards restricted the viewpoint in what had previously been all-round glass cases. Andrew Nahum (2010:178-180) noted the diorama technique remained fairly incidental to the main landscape of the museum until after World War II, a factor possibly reflecting the cost. Once installed, the Children’s Gallery was extended. The first set of dioramas dealt with *Transport through the Ages*; for the next, in 1933, with working models demonstrating principles behind communication and *Electricity in Modern Life*, Hartley was joined by William O’Dea, an ambitious assistant keeper trained in lighting engineering.

Working demonstrations were not classified as dioramas, but could have dioramic backgrounds; the artists responsible were even more invisible than diorama artists, but were identified through invoices. The backgrounds were not treated as museum objects, more as rather expensive wallpaper. Two providers of backgrounds stand out. E M Dinkel trained at technical college in Huddersfield, studied in London, served in France at the end of World War I, graduated from the Royal College of Art (RCA) in 1925 and joined the Underground Group for poster design. He taught at Goldsmith’s College and the RCA, retiring as Head of the School of Design at Edinburgh College of Art in 1961.168 Dunstan Mortimer, a generation later, was a scenic artist working on the Shipping gallery in 1958, and gradually included modelled aspects of scenes in front of background paintings. He was helped by Roussel, and worked with and after him on dioramas for the Science Museum and elsewhere.169

A new gallery on the history of lighting introduced another style of diorama alongside the Roussel group’s large skewed perspectives. The dolls’ house form featured a small box containing the required scene at a fixed scale. Follett (1978:115) wrongly claimed these were not dioramas as they showed interiors, although Roussel and others had created such scenes. Alexander Barclay, colleague of Hartley and O’Dea, organised the work to be prepared ‘by competent artists and modellers who are constantly employed on this

168 http://www.ltmcollection.org/posters/artist/artist.html?IXartist+Ernest+Michael+Dinkel; backgrounds to 1933-137 signalling demonstration, 1933-647 heliograph and 1933-648 Chappé semaphore tower, for which he was paid between £5 and £7.  
kind of work for cinematographic purposes'. They were overtly theatrical, very much cheaper than full-size dioramas, and produced by Hugh Gee of Art Direction Ltd. (Plate 17). The challenge here was to find suitably small light fittings. Background lighting was provided by off-stage incandescent light bulbs as for the larger dioramas, and push-buttons switched the effect between day and night. Post-handover, evidence of the maker’s identity to external viewers was limited to inconspicuous initials in a corner, and to internal staff through records of construction and payments in Museum files.

Both styles of background lighting were problematic. In small housings for miniature room scenes, incandescent bulbs sometimes caused scorching, noticed by smell and smoke, and obviated by inserting asbestos sheets. So the model later required careful handling, and at disposal was hazardous waste. For larger dioramas, light bulbs were set above and at the front, behind dust-proof panels (so changing light bulbs did not admit dust to the diorama below). Post-war, lighting technology moved on to fluorescent tubes, requiring entire scenes to be repainted. Shadows, painted out or in as required, now had to appear to come from a single light source (e.g. the sun for outdoor daylight), whilst the actual illumination came from a linear source, the tube. The artists were recalled to make the changes, which they did, but did not like. Roussel was most particular that no un-trained person should do this, thus reinforcing distinction between artists and technicians. An artistically-qualified junior curator was initially allowed to assist, but when the museum’s technicians discovered it, a union dispute over job descriptions put a stop to it immediately (Plate 18).

The next gallery to use dioramas was the Mining Gallery. Again, Hartley and O’Dea were behind it, cautiously sounding out Roussel in July 1938, for four scenes. He was invited to meet curators O’Dea and F Lebeter, the latter providing rough sketches in August. Roussel returned with roughs in August and September, Lebeter visited the studio in November, and a formal order was raised in December with a delivery date of March 1939. Unfortunately, this time it all went horribly wrong. Roussel was in a car accident and only finished one in time. As the other three had not even been started, it

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170 ScM 3710/5/1 Scheme for lighting exhibit, 16 February 1931.
171 ScM Nominal File – Hugh Gee.
172 Roussel and Whatley both worked on this at 10/- an hour – ‘There is no danger of either Mr Roussel or Mr Whatley spinning out his time. They look upon this work as an unmitigated nuisance’, ScM Nominal File Roussel, Hartley to Director, 22 October 1948.
173 Personal communication, John Smart, the former assistant curator, with my grateful thanks for sharing the story.
174 ScM Nominal File 5406 – Roussel.
1. Model warehouse, currently on show in *Making of the Modern World* [ScM image]

2. Tailor's shop lit by gaslight [ScM image]

3. Same model out of showcase, showing lamps, asbestos sheet
Roussel repainting *Mediaeval Ploughing* following lighting changes [ScM image]
is tempting to suppose the original group of artists was beginning to break up. By May 1939 only Whatley was regarded as being still able to produce dioramas of the required quality, but was not available. The museum chose one more, which Roussel was unable to deliver until 19 September 1939. But by then the country was at war.

South Kensington - Museum of Practical Geology

The centenary history of the Museum of Practical Geology (now the Earth Science galleries of the Natural History Museum) gives a much clearer idea of the creation of their dioramas than those in the other London institutions (Flett, 1937). The Geological Survey of Great Britain was assigned the plot of land next door to the Science Museum, replacing war-damaged premises in Jermyn Street. The architects at HM Office of Works were the same people who produced the Science Museum’s Exhibition Road building, using similar plans, with extra offices and laboratories being provided at the rear for the staffs of the Museum and the Survey (Ibid.:192). From the point of view of ANT, there were close connections between the institutions; geographically adjacent, they had similar layouts, and the almost matching new buildings had much improved facilities and brand new galleries to fill.

The buildings’ histories were not their only links. Personnel moved between them too, becoming mobile connections in ANT terms. The DSIR (Department of Science and Industrial Research) had from 1915 appointed a Board for the supervision and funding of research activities and from 1919 was responsible for the Geological Survey. The first chairman of the Geological Survey Board of the DSIR was Sir Francis Grant Ogilvie, from 1911-1920 Director of the Science Museum, and previously between 1900 and 1903 Director of the Royal Scottish Museum, Edinburgh. From 1920 he was the Principal Assistant Secretary of DSIR. Dr W F P McLintock, assistant curator at the old Museum of Practical Geology at Jermyn Street from 1907, joined the geological section of the Royal Scottish Museum’s Natural History Department from 1911 to 1920, returning to London as Curator and Librarian at Jermyn Street from 1920.

The Imperial Institute team also made dioramas for the Museum of Practical Geology. In an analogous situation to that of Sir William Furse, and writing in the Museums Journal soon after the new premises opened, McLintock realised

the geological museum officer would be wise to recognise the somewhat discouraging fact that the ordinary visitor regards geology as a dull, even repellent, subject ... that systematic collections of rocks, minerals and fossils, often bearing the most unfamiliar and unpronounceable names, did little to dispel the sense of misgiving with which the more courageous visitors ventured to
explore the geological galleries ... museums pursuing such a policy usually present a deserted and desolate appearance (1936:89).

Museum director Sir John Flett explicitly acknowledged the need for good contemporary displays, as the Natural History Museum, Victoria and Albert Museum, Science Museum and the Imperial Institute were known world-wide for the variety and excellence of their exhibits. So they chose artists ‘who had done similar work for other British museums’ – the very same ones.\textsuperscript{175} Roussel imposed similar contracts, with little reluctance by either Flett or McLintock to acknowledge artists’ names. Of sixteen dioramas made for the opening of the building in 1935, only two were made by people whose names are so far unfamiliar – Vernon Edwards and E M Wilson. The other makers were Roussel, Black, Rooke and Cawood, also known from postcards.\textsuperscript{176}

The designs were formulaic, saving on multiple orders. Even with site visits to establish scenic content for industries such as clay and slate mining, the artists worked quickly, six months between order and delivery being standard. The casework was free-standing; exhibition press reviews showed dioramas could be and were moved around the building as exhibitions changed (Plate 19).

Sixty two days after the new museum opened its doors, \textit{The Times} noted attendance running at about a thousand visitors a day. The (unnamed) journalist was struck by the contrast with the previous two years’ annual attendance of less than 21,000 at the dingy and dangerous Jermyn St premises. In 28 days between the opening of the new building and the end of July, ‘no fewer than 26,000 persons discovered in themselves a dawning interest in a despised science’.\textsuperscript{177} Undoubtedly he had been talking to McLintock.

The Museum continued to order dioramas, but the records became patchy. The models were not the usual raw material for geologists and earth scientists, and were not given the same inventory status as Science Museum ones. Here the sharpness of the drop in interest post-delivery in the identity of the model maker was greater than for the previous two institutions; model makers were regarded as suppliers, albeit skilled ones,

\textsuperscript{175} BGS Archives. The categories GSM/MG/C and GSM/MG/E contain papers related to the setting up of the museum at South Kensington, in numbered folders. The individual items within the folders carry the original reference numbers as used in the original correspondence; not every item carries such a reference and occasionally the date of the document has to be deduced from the contents. The minute from which this information is taken probably dates from November 1932.

\textsuperscript{176} Postcards regularly appear as collectibles on websites such as e-Bay.

\textsuperscript{177} \textit{The Times}, Friday, 6 Sep 1935; p15; issue 47162; col E – ‘The New Geological Museum – Average Attendance of 1,000 a Day’.
1. Museum of Practical Geology, 1935; dioramas can be seen between the pillars on the ground floor [NHM Lib,Mus J]

2. Diorama, *Carboniferous forest* by Roussel (a much-copied scene) [NHM image]

3. *Early Man in the Thames Valley* [Mus J]

4. The same, as finally produced [NHM image]
but lacking relevance after installation. Consequently, records of these almost ephemeral items were not kept together when they fell out of use. Former staff related anecdotes of dioramas being moved from galleries into office area corridors; after a merger with the Natural History Museum from 1988, the dioramas were dispersed, some to other homes where their back story was unknown. As models and artists went from wonderful to invisible, so did their records.

**The Medical Dioramas in the Wellcome Collection**

Sir Henry Wellcome (1853-1936, pharmaceutical entrepreneur) set up displays of medical history from about 1903, celebrating the 25th anniversary of trading by his company Burroughs Wellcome & Co. After an appeal for exhibits and assiduous collecting by his staff, he opened the Wellcome Historical Medical Museum in 1913 and a Museum of Medical Science in 1914. The 1926 Handbook included the speeches from the 1913 opening ceremony; from the start the historical museum’s lower floor contained full-size pharmacies of different periods and room settings showing medical practice. Other floors housed manuscripts, artwork and artefacts from primitive medicine, and other exhibits (Anon., 1926:72). Visiting required prior written application, no effort being made to attract non-specialists or children. Overall attendance was unsurprisingly low. Skinner noted one group of visitors for which Wellcome was prepared to cater were those guardians of the Empire whose duties brought them into contact with the ‘subject native races’ (1986:401): ‘Colonial and military officials, explorers, colonisers, planters, missionaries – would find it invaluable’ (Ibid.:383).

This attitude was not uncommon at the time, similar to that of the Imperial Institute; however, Wellcome was out of kilter with academic practices in anthropology and ethnography and his collections did not become a resource for serious study. During the 1980s they were rationalised and partially dispersed, much material including dioramas going to the Science Museum (Bracegirdle, 1981).

It is unclear whether the first galleries included dioramas or reduced-scale models. Wellcome often used replicas if he could not find the real thing, commissioning copy drawings, paintings, and historical reconstructions (Skinner, 1986:405). A named artist for copying work was Ernest Board, some of the subjects he illustrated appearing later as dioramas. Despite his museums’ inaccessibility to the general public, Wellcome

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179 Dioramas still extant include A626416 *Use of ether in operations*, A626415 *Laennec, the inventor of the stethoscope*, A626414 *Lavoisier’s laboratory*, and A608505 *Guy de Chauliac*
agreed to lend displays and exhibits to events such as the British Empire Exhibition at Wembley, Daukes’ display including enlarged wax models of insect pests such as mosquitoes. There are several examples of other loaned exhibits in the early 1930s; the first to mention dioramas was the 1933 Chicago Exposition (Anon., 1993:40-41) (Plate 20).

Of the twelve dioramas shown at Chicago, a handful carry a signature – that of Edward Ashenden, working with one of Wellcome’s staff, Mr Plot Jnr. Correspondence surviving from 1935 showed Ashenden was Instructor of Model-Making and Display at Chiswick Polytechnic School of Art, which occupied him for half a week at five guineas a week during term time; other commissions brought him a similar amount. He was not prepared to relinquish teaching, but offered to build three or four dioramas a year for £150 a year covering the costs of a studio in Fulham and assistants as required. A suggestion that he take on an apprentice at a premium of £50 per annum, for two years, was not immediately taken up, but some version of it must have been, as maquettes for four large scale dioramas, made by Ashenden with Plot’s assistance, were purchased from Ashenden’s widow in 1956.

In Wellcome’s Museums, an external artist could and did sign his work, and was acknowledged; anonymous pieces may have been made by full-time employees, who were not, although some (partial) names are known. There was no squeamishness about technicians working on dioramas, which were installed with headphones for talking labels and their own lighting systems; technician Mr V Axford was photographed attending to one. These dioramas were fairly compact and rather more mobile than some of the others. Individual ones were loaned to medical congresses, and no fewer than fourteen, some created specially, to the International Exhibition in Paris in 1937 – the Exposition Nationale des Arts et Techniques dans la Vie Moderne, or Art and Technology in Modern Life. Wellcome staff in both Paris and London were in direct

performing mediaeval dissections. Others known to have been created but of which the whereabouts are no longer known are Roger Bacon, the full-size versions of Pasteur and Lister in their respective laboratories, and Torricelli discovering the principles of the barometer.

Daukes’ contribution to the Wembley exhibition was mentioned in The Times, 25 Apr, 1931, pg 11; issue 45806; col D; Paris Colonial Exhibition. British Section.

181 Wellcome Library – WA/HMM/CO/Alp/1 Box 68 Ashenden.
182 ScM 1984-1456 a-d.
183 L0003405 Credit: Wellcome Library, London - Lister Operation, Diorama, with Mr. V. Axford repainting model for exhibition.
184 Wellcome Library Wellcome Collection, WA/HMM/EX Box 462 Paris 1937 Exhibition. Folders of notes and correspondence from which the story that follows has been deduced.
Plate 20

1. Chicago exhibition stand, 1933 [Wellcome image]

2. Diorama showing surgery [Wellcome image]

3. Mr Axford touching up the same diorama, reversed [Wellcome image]

4. Neolithic Trephination, Jane Jackson, 1942 [Wellcome image]
telegraphic communication over touching up paintwork, cleaning off dirty marks and fitting lamps and spotlights. When more space became available, they responded instantly to a telegram from Paris demanding ‘Dispatch Immediately Seven Dioramas’. A week later these were installed.

The exhibits returned, damaged. 31st August 1937. Great damage done to figures in 4 dioramas. Larger plaster figures removable (The bottom of the dioramas unscrewed or a small trapdoor placed there. All made by hand by an expert sculptor £7 or 8 apiece.). The dioramas had been insured for £120, and a claim would be made. It is circumstantial evidence not only of division of labour in diorama production, but also of hierarchy in types of art – the ‘artist’ was recognised as such, but although ‘expert’ remained unnamed.

The Wellcome Collection has been catalogued a number of times, and in various ways, the latest on transfer to the Science Museum in the early 1980s. It is possible to track some of the dioramas’ active lives, as they passed from gallery to store, but as ever archives are incomplete, the stories being compiled from multiple sources. Wellcome staff invisibility matches that of Science Museum staff; external consultants or contractors are named, and found through payments or other paperwork. Regrettably, there is no full account of the layout of the galleries from the 1940s to the transfer date, although the dioramas were installed in two series covering stages in the Growth of Modern Medicine, with lengthy labels (no makers mentioned) and postcards; neither of these sources is complete.

One notably visible employee was Jane Jackson, medical illustrator, celebrated in the 50th anniversary account of the history of the Wellcome Museum of Medical Sciences, produced by the staff (Anon., 1964:65-69). Her prodigious output of drawings and models included four named dioramas to be used as ‘arrest exhibits’, but which even by then had already been destroyed. A surviving diorama shows Neolithic trephination, made in 1942 (she signed and dated it). This was lent to a Science Museum exhibition in 1947, and had pride of place in a Wellcome Historical Museum exhibition in 1951. It was still on show at transfer, becoming the opening item in the Science Museum’s new medical galleries.

185 Box 462. 27 May 1937.
186 Wellcome Library Wellcome Collection, Box 463, E10.
187 ScM A608202; formerly R10/1951 Trephination in neolithic times.
188 The Times, 19 Sep 1947; p2; issue 50870; col B; SURGERY THROUGH THE AGES. Trephining Operation 4,000 Years Ago; the first exhibit is a diorama showing a trephination in
This collection exchange shows interaction between the Science Museum and the Wellcome Institute. A further connection saw Jane Jackson called in to complete a Roussel diorama, *Primitive Iron-smelting in Uganda*, for the 1959 Science Museum Iron and Steel Gallery,\(^{189}\) the only evidence being that the curator, Walter Winton, insisted she be invited to the gallery opening in gratitude.\(^{190}\)

**Post-war recovery**

The outbreak of World War II formed a milestone in many ways for the institutions and their diorama makers. The institutions closed or were converted to other purposes, collections being removed or stored to make space and as protection from bombing raids. Ashenden lost both his teaching work and his studio, applying unsuccessfully to the Wellcome Museums for full-time work. The Imperial Institute closed to visitors. The Science Museum dioramas were moved to the basement for the duration, with a very skeleton staff checking for damage or deterioration. As the Museum experienced little damage, it was not a high priority for post-war new build. Nonetheless, William O'Dea grabbed the opportunity to work with the Director Dr Herman Shaw towards a new Centre Block. This was planned initially for exhibitions related to the 1951 *Festival of Britain* on London’s South Bank, followed by a series of new industrial galleries – agriculture, gas mining and electric power (Rooney, 2010). The exhibition design excluded daylight, allowing total control of the visitor impression.

The *Festival of Britain* was the dominant British extravaganza of the early 1950s. London institutions overhauled their displays accordingly; a new style emerged using large photographs and graphic panels although dioramas were still produced (Whatman, 1959). The Imperial Institute too was changing. By 1962, it had become the Commonwealth Institute, relocated to a new building in High Street Kensington including a purpose-built diorama studio with Roussel still in charge. Exhibitions were erected under an innovatively-shaped roof designed by James Gardner, *Festival of Britain* designer (Gardner, 1993).

Shaw’s successor Frank Sherwood Taylor sat on one of the Festival Committees, and was impressed by very large dioramas in the *People of Britain* pavilion. However, these were too big for Science Museum galleries, so four similar but smaller dioramas were

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\(^{189}\) ScM 1959-105 *Iron-making in Uganda.*

\(^{190}\) ScM File No 8826 – *British Iron and Steel Federation.*

Despite restricted gallery space, the Science Museum re-opened in February 1946, and temporary exhibitions maintained visitor interest. But O’Dea did not forget the permanent galleries. Hartley approached Roussel again in 1948 with respect to the Mining Gallery dioramas; he had already produced three dioramas for the Gas Gallery, funded by industry subscriptions through the British Gas Federation. The first, showing William Murdoch lighting his Cornish home with experimental gaslight in 1792, was delivered and paid for in August 1944. Roussel re-thought the method of lighting in the dioramas; light bulbs were placed elsewhere than directly overhead and glass and mirror panels bounced light around the scene. Materials costs had increased, in some cases substantially. The new quote for dioramas was £210 each. Eight days of repairs to existing dioramas in 1948 cost £20 (Plate 21).

The Gas Gallery and the Agriculture Gallery faced each other across a main gangway on the first floor, leading to the new Centre Block. The gas dioramas were first displayed at Gas Industry House (home of the sponsors), only coming to the Museum when space was ready to receive them. Work depending on available funding, the final one was not installed until 1956, the last three being reconfigured. The Agriculture Gallery opened in 1951, several of its dioramas being made by other makers and gathered together (Insley, 2006). These included Mediaeval Ploughing by Roussel (originally made for another client, so this was its second active life), Horse Ploughing by Tom Ivester Lloyd (one of a series made in the 1930s and bought from his family in 1950, long after his death in 1942) and a third by Gordon Whatman (commissioned in 1955, showing Potato Planting in 1850). The rest, focusing on forms of farming activity throughout the year, were ordered en masse, from the successful bidder to competitive tender, Goacher Model Engineering Co. Ltd.

Mediaeval Ploughing was the last diorama by Roussel to remain on show until the beginning of 2017, when the gallery was dismantled. Changing from incandescent to fluorescent lighting gave the opportunity to photograph Roussel at work, the only image

191 ScM Nominal File 7941 – British Gas Federation.
192 ScM Nominal File 5406 – Roussel; Roussel to Hartley 3 Aug 1948.
Plate 21

1. Gas lighting 1792, Roussel [ScM image]          2. Horse ploughing, Ivester Lloyd


5. Basic oxygen steel plant, Mortimer [ScM image]
of him in the museum's holdings (plate 18). The series of dioramas including Ivester Lloyd's *Horse Ploughing* was much admired by Sir Mortimer Wheeler, Director of the London Museum, and Ivester Lloyd made more dioramas, for international exhibitions and for that museum, from 1930 onwards (Plate 22). He was an inveterate painter and draughtsman as well as model maker; his personal story was less difficult to uncover, but more detailed than there is room for here. Whilst remaining independent, he named his institutional clients on his letter headings. *Potato Planting* was the first work done for the Science Museum by its future first Head of Exhibition.194 Gordon Whatman studied painting at Norwich School of Art and Brighton College of Art, exhibiting in London from 1953.195 His diorama led to a permanent post as Drawing Assistant in 1955; eight years later he was promoted to Leading Illustrator, most of his work having been overseen in some way or another by O'Dea. He published a (rare) article about Roussel in 1959, and was naturally aware of and influenced by his work (Whatman, 1959).

Goacher Model Engineering won the contract for the agriculture dioramas at a rate of about £90 per diorama. Timing was tight, the solution being a painted box style, keeping background scenery as two-dimensional paintwork, and modelling baseboards to support true-perspective scale models of machinery. This was quick to install, and readily updateable, necessary within a decade. The museum’s main contact took over Goacher shortly afterwards, renaming it ‘A. Mash and Associates’. Despite pressures of time and funding, Mash obviously enjoyed working with the museum, almost immediately producing models for an exhibition on the inventions of Leonardo da Vinci (Bennett, 2015).

When the Agriculture Gallery opened in 1951, its success in encouraging young technically-minded people to consider careers in agricultural engineering was noted almost ruefully by the National Farmers Union, who had been running a campaign to do precisely that at the same time, at rather greater expense (West, 1967). Dioramas contributed to the success, alongside real tools, full-sized and model machinery in an environment where visual impact on the visitor was carefully designed.

Immediately post-war, Science Museum personnel tried to reconvene the artists they knew for ongoing gallery work, sometimes using imaginative ways to arrange funding. The extent to which the artists kept in contact with, or remained visible to, each other is unclear, but when the Imperial Institute studio moved to the Commonwealth Institute, it

194 ScM Z183/2 Papers relating to establishment of Exhibitions Officer Dept 8.
remained a focus for diorama work. All the artists undertook other forms of art, not least to earn money – there are frequent mentions in the files of their being short of cash, and therefore grateful for interim payments against work completed. O’Dea in return was evidently ready to try to beat prices down, even when he was already getting a good deal. Artists passed work between themselves – not only within the semi-formal group led by Roussel, but also between Cawood and Morewood, his assistant, and from Cawood to Carter. Sometimes links between artists were not very robust – as already noted, when Roussel had his traffic accident in 1939, nobody took over. Ashenden wanted to meet the person he might have to train before committing himself to two years of coaching; he and Mr Plot Jnr did work together. Museum personnel also kept tabs on who was where, and would be capable of taking on or completing work (Jane Jackson was called in to finish a Roussel job); remarks made in internal files noted there were other artists than Roussel and Whatley, but those two produced higher quality work. They were not invisible, but unacknowledged, and if not immediately required, irrelevant.

From the 1960s to the 1980s, more dioramas were commissioned for the huge Centre Block galleries. Roussel was chosen to attempt a 17-foot long model of the making of the M1 motorway, but he was in the beginnings of what was probably dementia, forgetting details and drawings and missing deadlines. The Science Museum staff turned to other modellers such as Jane Jackson, and younger ones such as Dunstan Mortimer. The ability to make models was not unique to these artists, as new names appeared, but livelihoods depended on the availability of work, and fashions changed. The Shipping Gallery made use of diorama-like scenes produced more cooperatively, with backboard, bases and displayed items created by different people, not recorded as an integrated whole as earlier more monolithic dioramas had been. Nonetheless, this was a springboard for talent. Dunstan Mortimer was an established scenic artist when first used by the Science Museum, but gradually introduced modelled aspects to his scenes, in time taking on Roussel-style work for the Commonwealth Institute and National Museums Scotland. Whatman was tested as an exhibition manager by covering small circulation exhibitions before being let loose on the Shipping and Aeronautical Galleries. Whilst working, the artists were not only visible, but observed.

They were appreciated by the curators. Mortimer’s last diorama for the Science Museum in 1972 showed the Basic Oxygen Steelworks at Port Talbot [South Wales]; the required foreshortening compressed the view down a mile-long building into a depth of three feet (Insley, 2007b). Whilst determining who should make it, the curators came up against Civil Service regulations stipulating that multiple tenders should be
considered for the work. Roussel had died in 1966; Louis Duffy, another fine artist whose career has not been recounted here, was fully engaged elsewhere in the museum, and ‘This leaves Mr Mortimer as the only diorama painter known to us as able to undertake the kind of work that we require’.\(^{196}\) He produced preliminary sketches, went on a site visit with the rest of the team and had photographs and plans to work from. When the then Director raised a final quibble, the curator Frank Greenaway concluded:

> If we wait for a hypothetical condition of open competition to arise, we may wait for ever. Practical expedition must be weighed against conjectural economies in achieving our objective. While we are not seeking to commission a comparable work of art, it might be worth reflecting whether Pope Clement VII put the Sistine Chapel job out to tender.\(^{197}\)

As mentioned, the Science Museum took over the Wellcome collections in the 1980s, re-using some dioramas and commissioning new ones. One of three medical galleries, *Glimpses of Medical History*, was turned over completely to life-size room settings interspersed with dioramas. Fortunately, some of the required skills were still available; one of the model-making companies, Derek and Pat Freeborn, had supplied work to Gardner at the *Festival of Britain* (Gardner, 1993:457). But museum techniques of display and interactivity moved on; the Science Museum neither commissioned nor produced new dioramas from the late 1980s. The medical and agriculture galleries are dismantled, the models stored or dispersed.

**Wider context: dioramas and their makers**

The dioramas in my study have a prehistory in landscape modelling from the late 18\(^{\text{th}}\) century, through various forms of public spectacle including battlefield models, great exhibitions and railway layouts, before finding their niche after the British Empire Exhibition in 1924. Through the 1930s, tens or possibly hundreds were created for museums and other public displays, retaining their popularity even as other visual media such as television grew in importance for public entertainment and informal education. As a display format the diorama passed in and out of fashion (currently eclipsed, at the Science Museum). However, recent work shows natural history dioramas with taxidermy specimens are experiencing a revival for informal science learning research.\(^{198}\)

When I joined the Science Museum in 1974, the earliest dioramas were a silent presence in the basement – I have no particular recollection of ever seeing them there.

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\(^{196}\) ScM Nominal File 9661 *Dunstan Mortimer*.  
\(^{197}\) Ibid., 30 November 1970.  
\(^{198}\) See for instance Tunnicliffe (2015); also natural history dioramas at Norwich Castle Museum.
When I began to take an interest in the mid-2000s, the basement was cleared, and two remaining galleries containing dioramas, *Agriculture* and *Medical History*, were considered for revamp or removal; by the beginning of 2017 these too were dismantled. The dioramas were removed to store or disposal, under the terms of the National Heritage Act 1983, information about them relying primarily on internal documentation.

Searching for wider context of the diorama as museum display technique, it was reasonable to consider museum publications including dioramas (Aldred, 1979; Quinn, 2006; Back & Webster, 2008; Gall & Trischler (eds), 2016). Science Museum publications with brief diorama references included gallery guides (some running to many editions), catalogues, handbooks, museum histories and general guides (discussed in more detail later) (Hartley, 1935; O’Dea, 1948; Greenaway, 1957; Follett, 1978; Morris (ed), 2010; van Riemsdijk, 1965; van Riemsdijk & Sharp, 1968). For the Wellcome medical history collection, a dedicated guide described existing medical dioramas with interesting histories and newly commissioned ones (Bracegirdle, 1981).

One of the most fruitful sources for diorama artists and their work was *The Times* online, available to me at the Science Museum before retirement, and hugely useful in determining their stories. Following the work of the artists showed dioramas were made in substantial numbers for the Wellcome collections (Anon., 1933; Anon., 1964), the Museum of Practical Geology (Flett, 1937), the Commonwealth Institute (Anon., 1967), and the Museum of London. Searching for stories of modelling skills, I found non-museum scholarship exploring toy soldiers (Garrett, 1959), a study of two of the most iconic battlefield models ever made (Hofschröer, 2004), histories of model making firms (such as Fuller, 1982) and former institutions (Golant, 1984), and trade literature for London shows and spectacle (Altick, 1978).

More substantial works relating dioramas to other academic interests included Wonders (1993) on habitat dioramas, which first inspired me to pursue diorama research. Rader and Cain (2014) extended Wonders’ work, comparing development of natural history displays with progress of biological science. General research compilations include conference submissions, such as Meecham (2008) and commissioned chapters in a Deutsches Museum publication edited by Gall and Trischler (2016). Others in the museum sector have occasionally commented on dioramas.

A small but occasionally useful group of works were biographies and autobiographies of some of the *dramatis personae* – senior museum staff (Mortimer Wheeler, 1955; ffoulkes, 1935; Anderson (ed), 2007), family members of modellers (Bassett-Lowke, 1999) and one of the architects of the Commonwealth Institute building in Kensington.
(Gardner, 1993). And some of the artists themselves published – Tom Ivester Lloyd, Barbara Campbell and Hugh Gee produced children’s books (not cited here). Writings about dioramas by makers are almost non-existent, with the exception of Whatman’s article about Roussel. Academic interest in dioramas has experienced a resurgence lately, mainly featuring their role as display devices for natural history specimens and educational aids, rather than the mechanics of their making and identities of makers (Scheersoi and Tunnicliffe, 2018).

Searching for diorama makers in trade directories was only partially successful. Leads obtained from correspondence in museum files were not always repeated in directories. Some artists do appear; others do not, possibly because, if they were working for a particular institution (as with employed architectural assistants), they would not have been the main receivers of letters. However, Edward Ashenden, model maker, architectural, was listed as offering dioramas, models and displays from 7 & 15 Chenil Studio, Kings Road, SW3 in 1952; examples of his work are in the Science Museum, London, having arrived there via the Wellcome collections. Both Roussel and Cawood appeared as residents in Streets sections, and as artists in Trades sections.

The wider context for dioramas is a separation from other forms of public spectacle during the end of the 19th century, particularly for natural history examples, and a burgeoning interest in hobby modelling, miniaturisation of engineering icons such as ships and trains, and on-going enthusiasm for toy soldiers, battlefield models and the like, the individual forms having largely independent histories. The Imperial War Museum opened in 1919 with an exhibition of work done by women at war, using dioramas made by the very people who had performed the war work. This was re-celebrated in an exhibition at the museum before its most recent refurbishment, and again in 2018 as part of the WWI centenary (‘A Closer Look’, 2018).

The British Empire Exhibition brought together the artists who produce the museum diorama format. The impact of their work at the Imperial Institute changed the look of exhibitions at the Science Museum and the Geological Museum through the inter-war period. The interest shown by The Times in reporting London’s new dioramas does not appear to have been followed elsewhere – few other cities were mentioned as having similar exhibits. Using dioramas in archaeological displays was taken up in Edinburgh’s Royal Scottish Museum but not London’s British Museum.

Other London institutions using dioramas in a major way were the London Museum and the Wellcome History of Medicine Museum. The London Museum, later the Museum of
London, commissioned a series from Tom Ivester Lloyd showing the ‘development of the British race’ for exhibition in 1937 at first in Antwerp, then Buenos Aires, before finding a more permanent home at Kensington Palace, and subsequently moving to the City (Plate 22). The Wellcome Museum’s first dioramas were made for the Chicago Exposition of 1933, in a small-size, self-contained box structure style. Later ones were made for the Euston Road galleries under contract by Ashenden; there may have been other artists involved but the documentation is lacking. Other dioramas were made or refurbished by in-house staff such as Jane Jackson (thesis:122). The Times mentioned other exhibits in such pop-up venues as underground tube stations. Imperial Institute dioramas were lent to trade shows and exhibitions rather more frequently than one might have assumed, given their size and relative fragility.

Internationally, three major museums have celebrated their dioramas by publishing books about them. Stephen Quinn’s *Windows on Nature* (2006:15) described the dioramas in the American Museum of Natural History. The Akeley Hall of African Mammals opened in 1936, after 27 years of careful collection and preparation of specimens, backgrounds and a hall specially built for their display. Carl Akeley’s muskrat diorama made for the Milwaukee Public Museum in 1889 is credited as the first habitat diorama, a developed form of settings created by Charles Wilson Peale in Philadelphia from 1786 (Sellers, 1980) and bird settings seen in London’s natural history division of the British Museum in 1885. Quinn included biographies of taxidermists, background artists and foreground artists working for the American Museum of Natural History, identifying specialisation in the collaborative teams making some of the largest dioramas ever made – in 1996, 26 artists and scientists went to the Central African Republic to collect references for a 100ft wide, 30 ft deep, 20 ft tall replica of an African rain forest, for the Hall of Biodiversity (2006:21).

The Australian War Memorial, Canberra, opened in 1941, aiming to give a sense of what it was like to be a soldier in the Great War. Laura Back and Laura Webster, in *Moments in Time*, quote William Siborne’s model of the battle of Waterloo of 1838 (currently at the National Army Museum, London) as a major inspiration for the Memorial’s founder Charles Bean (2008:6). His vision was that his dioramas should achieve the status of ‘high art’, and he commissioned professional artists and sculptors to work on them exclusively. The book gives the story of the production of the dioramas,

[Image supplied by Museum of London]
illustrates surviving ones, lists those no longer in existence and gives biographies of the artists who worked on them. The dioramas have recently been refurbished (thesis:237).

The Deutsches Museum’s wider survey (Gall and Trischler (eds) (2016), featured not only their own dioramas (focusing on how they were made, maritime examples of picture dioramas, underwater features, sectioned models, indoor and outdoor scenes, and railway layouts) but also those elsewhere, in various forms and subject areas. I wrote on the Science Museum’s examples of science and technology, Karen Wonders on habitat dioramas in German, American, Swedish and Canadian museums (ibid.:286-318); others discussed dioramas for environmental learning, pre-historic archaeology, tin figures, religious scenes, ethnology and the Holocaust.

A single collection of dioramas features in The Nutshell Studies of Unexplained Death (Botz, 2004). Corinne Botz has described and photographed eighteen doll’s house type models of crime scenes, commissioned by the founder of Harvard’s Department of Legal Medicine in 1936, Frances Glessner Lee. She was a master criminal investigator, and, as a captain in the New Hampshire police, used these dioramas in the 1930s and 1940s to train detectives; this practice continues today.

Current work using dioramas and miniature scenes continues. Sue Dale Tunnicliffe and Annette Scheersoi are active in collating projects using mostly habitat dioramas in educational settings. Artists interested in miniaturisation include the Chapman brothers, who have exhibited at the Royal Academy (Apocalypse, 2000); Willard Wigan, who fits model figures into the eyes of sewing needles (Willard Wigan', 2017), and the photographer Slinkachu, who situates little figures in urban environments (Slinkachu, 2008). Several of these examples feature in Simon Garfield’s In Miniature, published in 2018 and reviewed in The Observer (Martin, 2018).

For individual dioramas, actor-network diagrams analogous to Diagram 1 would apply. Diagram 3 has a rather different shape to the others, being focused more around the makers as the main feature, and showing otherwise invisible institutional relations linking them.

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199 Tunnicliffe and Scheersoi (2015); Scheersoi and Tunnicliffe (2018).
The 1920s history of the makers included an international exhibition and neighbouring museums; as the ScM dioramas were made in the 1930s, others were being constructed by the same people, for another museum, the institutions being linked not only by building structure but also by interchanging personnel. Two generations of curators and artists were involved, the main sources of information being internal documents and external newspaper exhibition reporting. Even though the makers were trained artists, they nonetheless remained largely anonymous, despite on-going interest by institution staff in being able to call on their services, and inconvenience being caused as fewer artists had both skills and availability to do the work through the 1950s.
and 1960s. The Science Museum acquired the Wellcome’s medical dioramas when the Wellcome’s priorities changed in the 1980s, and more were made then in the last major flurry of diorama work. Diorama installations coincided with huge increases in attendances at the institutions; the makers by and large remained secondary, although Roussel’s contract method attempted to redress that imbalance.

Interest in using human activity dioramas, although small scale (possibly as a result of the expense), was international, with significant applications of the technique in Australia (Canberra) and Europe (Munich, Vienna). Future work should consider other model-making traditions in the countries involved, such as wood-carving, city models, and battle scenes.

**Summary**

Materials: Short active lives (lack of durability) would arise naturally with flimsy construction materials. Rough-hewn wooden models to guide Cathedral masons were burned as rubbish almost immediately. The first Burges model was described as flimsy in the *Daily Telegraph* (thesis:82) without details of why they thought this, and the second one was praised for its construction, the criticism being directed at the decoration and its suitability for the Cathedral. Card was used for crystal models (which survive), toy theatre-style dioramas for post-war lighting gallery (which do not but are known from photographs), and a splendid multi-layer factory scene made from numerous layers of coloured paper by Roussel for the Electric Power gallery, which has always been handled carefully. An unfortunate maintenance issue involved using asbestos sheet as a fire precaution, inadvertently converting some dioramas to hazardous waste when no longer on show.

Size: Many of the crystal models were simply too small to carry a maker’s name, although a couple have inked initials. Dioramas and architectural models can be both bulky and fragile; once no longer required for regular use, deep, relatively inaccessible storage keeps them safe but invisible. They may also be taken to pieces for movement or storage, but requiring careful and comprehensive documentation to keep track of the whole. Later diorama displays were created by several people working separately.

Handling: Fragile paper labels have fallen off crystal models, making identification difficult; number labelling has varied, with paint and ink on stands being durable, scorch numbers being covered by later card labels glued over them, and enamel paint falling off metal models. These handling hazards have been compounded by the lack of full
recording (of acquisition, contents, provenance, maker, price, date, location, and multiple numbering systems). Generally, specimen crystals are handled with greater care, being intrinsically more fragile, and the crystal models were intended for handling, which increases risk of carelessness, and a sense that they were in some way less important.

Being separated from documentation: Where crystal models are no longer kept alongside the texts which refer to them, identification becomes fraught. It is now common for papers relating to acquisition and other administrative records to be stored with other papers rather than alongside the objects to which they refer, a feature shared by all three model types.

Relating to reference originals: Crystal models were occasionally stored alongside specimens they represented, good for identification but not for keeping the entire set together as an entity in its own right. Similarly, the converse applied to display, where much of the set would not be shown, and keeping the locations of all the components recorded is a perennial problem for collection managers – some models were removed and not returned, others were lost.

Exhibition: This offers the greatest visibility for any model, but depends on fitting in to an appropriate scheme. The 1911 Crystallography Gallery was the highest point of visibility for the crystal models, lasting a decade or so; dioramas once installed could stay in situ for decades, simply for being too bulky to move around very far, despite having casework designed to enable this. Architectural models had exhibition exposure to very small audiences, measured sometimes in days rather than years, but with occasional attempts to increase the possibility. Exhibition relies on relevance of model to subject, and the story being told about the subject; once models became peripheral to mainstream crystallography teaching, they were gradually removed from view, and if unmentioned in standard texts would not be used. Architectural models of unsuccessful schemes are also removed from prominence, and may also be under-described whilst on show, the maker’s name being subsidiary to the architect’s. Dioramas no longer wanted for exhibition can sometimes be offered to other institutions, in some cases becoming a valued statement exhibit, in the same way that those lent to trade fairs could be. Detailed layouts of exhibitions where they formed a part are extremely rare for dioramas, and hugely useful if known.
Some notable moments of perhaps unexpected visibility for models include the Great Model loan to South Kensington for exhibit and potential conservation; inspection by other consulting artists prior to their own designs; being used to test a new photographic method; having display urged by the external consultant on the Reparation Committee, and in *Pall Mall Magazine*; and being specifically requested following a competition which equally specifically ruled out model submissions; the 1911 enthusiasm for a crystallography gallery; a scientist making clay models for specimens he lacked; Roussel’s contracts; use of dioramas in trade shows.

Although the focus of this chapter was on models, a number of factors arose concerning invisibilities for human actors; minimal post-handover involvement or continuing contact with institution staff, excepting repairs; this leading to forgetfulness by later researchers; lack of documentation concerning initial appointment; being unnamed by employer or publishers in publications or unindexed captions for catalogue entries and illustrations (which might have been the cause of Roussel’s contract idea?); an insufficiency of full time work, requiring other work for survival; being seen as suppliers; being maintenance or technical staff assisting professors, architects, Clerks of works, or controlling curators.

Surprising visibility for human ANT actors arose from considering the opportunities for auto-didacts; acknowledgement on title page and library catalogue of illustration details (Lowry), an exhibition opening invitation (Jackson); and having an unusual name (Whellock).

The next chapter considers the makers, surveying aspects of the trade of model making from a more general standpoint.
3 Model Makers

3.1 Introduction

Simple questions about the makers, such as who was making models and where and when, were not simple to answer. As ANT actors, what did the makers do? The collections held only a few background stories, illuminating general points about the invisibility of small businesses. Relevant literature is small and named makers few, so I conducted a more general survey through trade directories, a standard independent historical source I had used during my professional career, for London-based model makers, initially with architectural model makers in mind. Model-making and modelling (the distinction is between whole and part buildings) were regarded as a combined trade from the latter half of the 19th century; some of the other makers appeared in the search. Lacking specific records, my findings are necessarily general, but give evidence for where makers worked, how long businesses survived, and a sense of how successful they were. Further general literature was consulted for background to how they might have become makers; their possible education (literacy, drawing), the importance of self-help and the availability or otherwise of training (for artists, artisans, and architects). How did the makers see themselves, and how did their clients see them? The question of the distinction between artists and craftsmen arose here, and I consulted literature for the history of attitudes to craft and models, to see how invisibilities of the kind I noticed might arise.

Finding model makers

In searching London trade directories for model makers in London, I began with architectural modellers; there were likely to be many more of them in formal employment than of (frankly, obscure) crystal model makers, or (later) diorama makers. Directories give names, addresses and occupation, occasionally alongside other unique information. They were developed from business almanacs, aiming for commercial benefit for the compilers (Atkins, 1990). The Post Office London Directory (POLD) is the most well-known, covering the years between 1800 and 1991 in print, and accessible to me in nearby libraries.200 Up to 1847 the POLD was compiled by people who delivered letters; later, agents were employed seasonally to collect and check the information (Ibid.:31-57). Numbers of entries and geographic coverage expanded during the first half of the 19th century, from 9000 entries in 1800, in a volume small enough to read in its entirety, to 150,000 in 1846, reflecting changes in the boundaries of City and

200 The Guildhall Library, the library of the Bishopsgate Institute and the Science Museum Library, the latter being where I had first used them as a research tool.
parishes, suburbs and adjoining counties. Invisibilities occur within this data pool, for reasons such as being unable or unwilling to afford to subscribe, being out when the agent called, having premises off the main street, not being the main proprietor at the address, or living and working in different places.

To generate a suitable list of names I started with arguably the most significant British 19th century exhibition, the Great Exhibition of the Works of Industry of All Nations (1851). Staged in the iconic Crystal Palace in London’s Hyde Park, an international showcase for manufactures and products, any architectural model shown here would have been top quality. Building models appeared in the catalogue’s Section XXX Sculpture and the Plastic Arts (Anon., 1851); entries named the designer, sometimes the maker, with addresses and (variable) information about each model. I could track exhibitors through earlier and later trade directories but not necessarily find other makers – another source of invisibility; the names might be there, but not seen by me. Trade directories are increasingly available on-line, but coverage is incomplete.

Early editions of the POLD were not subdivided by trade; names appeared, in alphabetical order of surname (although directories produced by both Pigot from 1822 and Robson from the 1830s did classify trades).201 Once subdivided, modellers and model makers – premises occupants chose how to name their trade – were listed together, sometimes with a distinguishing symbol indicating the type of models they specialised in. Listing-by-trade, indicating how the makers saw themselves, was key to business self-promotion, and I return to this point later, not least because none of the 1851 exhibitors of architectural models described themselves as architectural model makers (thesis:162). For the years between 1800 and 1991, I assembled 186 names and addresses for people who and businesses which may have made architectural models, given in the Appendix (Plate 23).

Another fruitful source for information about some names was Mapping Sculpture, a website compiled by a consortium including the V&A and sixteen other institutions (‘Mapping Sculpture’, 2011). Their time span was the century between the Great Exhibition and the Festival of Britain, shorter than mine; makers involved in architectural sculpture and allied crafts and trades were sometimes included, but again within limits. The website focused on sculpture, not architecture; their searches were from a selection of directories for the main cities in the UK and Ireland, from other published works.

201 The Bishopsgate Institute library holds a selection of directories including early ones published by Pigot and Robson.
1. The first London Directory, 1799 [BisL]
   2. A notable name – The Prime Minister’s grandfather [BisL]

3. Entry for George Bartlet [sic], architectural model maker, 1839 [BisL]

4. Contents [BisL]
   5. Geographical spread [BisL]

6. Increasing numbers of entries per page [BisL]
including exhibition records and catalogues, records of bodies such as the Royal Academy, art schools, related Guilds and Societies, and census and probate records for found names. Intriguingly for me, searching ‘Architectural Modeller’ produced 40 names of individuals and 39 business names, but not a single reference to extant artefacts in public collections. National collections being a natural place to look for architectural models, this was surprising, another source of invisibility highlighting the minor position occupied by these models in art history (individual items of huge significance notwithstanding). Where sculptors produced pieces still erected in or on buildings these were often mentioned.

My directory search included more general model makers. There was no overlap with crystal model producers; I found a handful of the latter labelled as mineralogists and booksellers. Diorama makers appeared as artists if they appeared at all, not model makers, and, where that category was sub-divided, as commercial artists. Both crystal model and diorama makers were fewer in number than architectural modellers, neither being listed as distinct specialities.

A major group of unmentioned practitioners was that of model makers working in-house for other people or institutions, in intrinsic invisibility. These might be specialist modellers, or architects in training; other research has shown the number of people skilled enough to be able to produce an architectural model would have been far larger than the number making it their main livelihood (Insley, 2017). Directory searches give an indicative rather than comprehensive view of the trade.

Only a few makers in the list were represented by work in the collections at St Paul’s Cathedral. Models commissioned by secular staff at the Cathedral were made for the architect, by unnamed makers. Models made elsewhere and subsequently offered to the Cathedral did sometimes carry maker’s names. Partridges Models Ltd made a model of the previous Cathedral to Wren’s in 1929, for an exhibition of models of Old London, described and illustrated in The Builder;202 details found from information on the maker’s plaque on the base. William Tite, architect, exhibited a design for part of the Royal Exchange in 1851,203 and served on one of the Art Committees assessing Penrose’s work in the 1860s. Farmer and Brindley, to whom I return later, did masonry, sculpture and other work for the Cathedral, and did make architectural models, but not for the Cathedral collection. By the end of the 19th century, they were one of the two largest London firms handling architectural decoration (thesis:145, 167-169). The

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202 SPC 559, labelled ‘Old St Paul’s, lent by The Builder’. The Builder, 1929, 22 February, p. 388. Also (thesis:97).
203 Anon., 1851:831, entry no 182.
longest-lived architectural modelling firm of them all, Thorp Model Makers, Ltd (thesis:144-145), (a terminal ‘e’ in Thorp was dropped in 1954) restored and altered the Burges/Whellock model of the apse, dome and choir in 1949, a job not explicitly documented in any files I have yet found in Cathedral archives, but illustrated in Moon (2004:138), albeit with an incorrect caption (Plate 24).

**Size, place, duration**

Trade directory entries suggest a number of features about model making businesses. Many were small, and records may not survive in archives (Brown, 1996:6). Seventy seven had one name at a single address, or several addresses occupied sequentially rather than simultaneously (thesis:241, note 1). It is as though they arrive, set up business, work, and then go; seeking further details is generally beyond this present work. Twelve partnerships had two surnames or more at the same address (ibid.:note 2). Reasons for this cannot be deduced solely from entries; possibilities include pressure of more work than one person could handle, possession of complementary skills, or requiring joint or additional finance. Other kinds of partnership had only one lead name, implying hierarchy within the business. Succession could be indicated when children joined the business (usually sons) (ibid.: note 3); the visibility of a son in the firm’s name demonstrated confidence, optimism and continuity. Entries for the Herbert, Jackson and Jarvis families were more complex.

The Herbert family worked in London between 1844 and 1889, with at least four individuals operating at times as two partner pairs, and sharing addresses in Drury Lane and Euston Road. The Jacksons, lasting over 50 years from 1883, periodically re-described themselves, as *Architectural Model Maker* from 1922 to 1928, as *Model Maker* between 1922 and 1925, and *Modellers* from 1922 to the last entry in 1933, with another partnership with another name in 1932 no longer mentioning architectural modelling. William Reform Jarvis operated from only two addresses over 71 years, naming a son only after 60 years of business (thesis:252).

Family connections of other forms (more than one person with the same surname) were implied by related addresses (thesis:242, note 8). Occasionally, listings imply takeover; the same address is used the following year by a different maker. Advertising a new

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204 eg genealogy sources for births, marriages, deaths, wills; censuses; company records, etc.
1. Column of model makers, including photograph [BisL]

2. Thorp (top left) under Model Makers,
   Farmer and Brindley (centre) under Modellers [BisL]
start-up may show the proprietor branching out after working elsewhere (ibid.:note 9). Six businesses added ‘& Co’ to their name, possibly indicating increasing size. The addition of ‘Ltd’ had further business implications, with nearly half (nine) set up or changing their name this way in the 1980s.

The type of premises could indicate how fit the business was to handle the work, the address being a significant indicator of visibility. In the early 19th century, it is tempting to suppose the craftsman worked at home or lived above the workshop. It is not possible from the addresses alone to establish what actually happened, but a few names give clues (thesis:241, note 4). Six had ‘studio’ in the address; Kenneth McCutcheon appeared for the first time in POLD in Bradley’s Buildings in 1939, but after the war set up McCutcheon Studio in West London, between 1949 and 1975 (McCutcheon, 1936:459). Bradley’s Buildings itself sounds like a place where several small businesses could co-locate. Hercules Buildings was home to Casentini and Wilson (1856-1860) and to Farmer and Brindley (1877-1882) (thesis:140,142 (pl 24), and 167-169). Some premises were described as ‘Works’, or ‘Units’; others had addresses implying ease of transport and access for manufacturing – Wharf Road, Ham Yard, Camden Lock. Several had addresses that were mews, passages or lanes – round the back from the main street, which, as Atkins (op. cit.) has shown, risked being omitted from the directory altogether, although not for these.

For multiple simultaneous addresses, one might be a showroom, another a workshop. Fourteen used adjacent properties (thesis:241 note 5); eighteen had completely separate premises (thesis:241 note 6). Occasionally, there were separate makers with the same address, but not necessarily at the same time (four pairs). Some makers were physically located close to each other, which at busy times would have been convenient for factoring, or farming out surplus work. The Hanway St. Works appears to have been particularly useful, with three independent makers setting up businesses there at 50 year intervals over a century.

Directory entries do not give reasons for entering business, leaving, or omission; clues to invisibility lie elsewhere. Moving out of the area of coverage by the Directory, retirement, changing line of work, bankruptcy – the possibilities continue. However, although a third of the 186 names in my list did not last three years, and half less than a decade, a sizeable number had settled and successful businesses, with 24 continuing

Webb in 1884, Baird (from the start) 1914, Boekbinder 1910-1913, Braun from 1902, Marshall from 1904, and Tett from 1900.

Boekbinder/Battiscombe and Harris, Forth Dimension/Robank, CB/KB, Farmer and Brindley/Casentini and Wilson.
for more than 20 years, and five (Jackson, Brucciani, Jarvis, Thorpe and Farmer & Brindley) for more than half a century. These five averaged nearly 65 years; the 20 longest-lived businesses averaged nearly 37 years (thesis:241, note 7).

At the other end of the longevity scale, of the 40 who only appeared once, nine showed at the Great Exhibition (1851); their exhibits may have been glorious one-off pieces, while they were actually based elsewhere. Four appeared in the last year the directories were physically printed, perhaps to ensure they appeared in volumes with a longer life on workshop shelves than annually updated ones. Three single year entries appeared in the peak year of 1869 (which had 19 entries), and one in 1876, a peak year with 16 entries. Reasons for these are unclear. Nineteen were noted for the last time in 1991. This does not mean their businesses closed down, just that the source directory was no longer produced, so their business life seems artificially short.

Of the most visible, longest-lived businesses, Thorpe, Farmer and Brindley and Brucciani merit further attention. Here I give further details for the first two, and for another Great Exhibition exhibitor, Thomas Wilby; I discuss Brucciani in more detail later (thesis:176-177), his longest business strand involving plaster cast copying.

John B Thorpe, founder of one of the longest lived modelling companies in this survey, first appeared in the POLD in 1904 at 98 Gray’s Inn Road, WC, under Model maker rather than Modeller, architectural. This was a little odd as he noted himself as an architectural model maker in his entry. He also offered ‘models of buildings, estates, works &c for exhibitors or law cases’, the last being a rationale for model making that was new to me. In yet another rather strange example of invisibility, in 1906 he invited readers to ‘Write for pamphlet with views of work executed during 20 years. TN 1011 Holborn’, implying he began making models in about 1886. The basis under which this happened was not given, but was an earlier business with a different name. In 1909 the entry reads ‘maker of the noted models of “Old London” at the Franco-British Exhibition of 1908 – write for pamphlet with views of work executed during 25 years’. This extends his active modelling life back another two years, and it is not clear which is correct. His re-descriptions continued; in 1917 he offered ‘Models of buildings, estates, works &c, for law cases or exhibition’; from 1922 to 1936 he had listings under two headings, both Model maker and Model maker, architectural. The distinction between the two was clarified between 1936 and 1940 – the Model maker entry read ‘architectural, engineering and inventors models’; and up to 1946 Model maker, architectural included ‘buildings, estates, works etc for law cases, exhibitions or

\[208\] Thorp’s archives are under discussion for preservation (Nov 2018).
inventors’. Throughout, the address (and 1883 as the year of establishment) remained the same, but in 1954 the terminal ‘e’ in Thorpe was dispensed with. Between 1970 and 1988, ‘Thorp Model Makers Ltd’ inserted a range of box advertisements, under both architectural and model maker listings. From 1975 they also advertised as ‘suppliers of materials for architects’ own models’, under Model Makers materials, offering a complete architectural range for office mock-ups or exhibitions, and as Model Photographers - ‘(Photoscope, eye level photography: a new direction in model presentation)’. In 1979 their category changed again to Model (Architectural) Construction or Dealers, and in 1983 to Model (architectural) makers/constructors. In the final year of survey, 1991, they featured as one of the top five entries, above the main listing, at 88 Gray’s Inn Road, under Model makers. Karen Moon unearthed more details from Thorpe’s own archive (Moon, 2005:144-146). Thorpe trained as an architect, then set up a Drawing and Tracing Company in 1883, advertising in The Builder and elsewhere. A 1949 photograph shows Thorpe’s son Leslie working on the Burges model of the apse, choir and sanctuary of St Paul’s Cathedral (Ibid.:138).

Farmer and Brindley are peripheral to the St Paul’s Cathedral story here, but hugely significant in London business history. They first appeared as an Architectural modelling partnership in the directories for 1877, and for six years worked at 67 Westminster Bridge Road and Hercules Buildings. Before this time, they were invisible to this investigation but known as stone masons and carvers. Between 1883 and 1912 they were at 63 Westminster Bridge Road, in 1908 becoming a Limited Company, and also listed under Model Maker. From 1913 to 1921 Farmer and Brindley Ltd continued at number 63; in 1919 they also had a much larger entry under Monumental masons, and continued to advertise as such to 1928. Between 1922 and 1928 they were listed under both Model Makers and Modellers; in 1929 under Modellers only. Mapping Sculpture on the other hand described them as active between 1851 and 1929, and listed at various times as sculptor, marble merchant, stonemason, marble quarrier, architectural modeller, marble decorator, marble importer and wood carver. Diversification in supplying specialist materials, particularly marbles, was more fundamental to their success than architectural model making.

Thomas Wilby’s story is local to St Paul’s Cathedral, and illuminates a number of invisibilities. Thomas Wilby exhibited at the Great Exhibition (1851) as ‘maker’ of a ‘Model of St Paul’s cathedral [sic] in Cardboard’. He lived at St Bartholomew’s

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209 Afternote: they are now based in Sunningdale, Berkshire.
210 SPC 353.
211 Anon., 1851, p.830, entry 162.
Hospital, POLD searches showing a Thomas Wilby listed there as Junior Renter from 1843 to 1848. Hospital archives showed that the model maker was very probably the son of the renter. His name was sufficiently unusual for other family members with Hospital connections to be identified. His father died in 1847, the Wilby family moving within the estate. This suggests the name no longer appeared in directories because they were further away from the main gate, where directory agents would have called to check entries. In the earliest 1799 edition of the Post Office Directory, a William Wilby, tinsel lace manufacturer, was recorded at 75 Little Britain. Whatever that profession entailed, William was clearly good at it, as he was still there in 1830. Little Britain is very close to St Bartholomew’s Hospital; a family connection is likely.

The Royal Commission for the Great Exhibition (1851), housed at Imperial College, holds records and reports of Juries for the various classes, but not preliminary correspondence encouraging exhibits. According to Angela Kenny, Archivist, local committees arranged support, raised funds and chose exhibits; the archive holds only basic information from these committees, but more may survive in local record offices. For Wilby’s model, the local committee would have been the City; there is no entry for Wilby at Imperial College.²¹²

In the absence of further corroborative evidence, I suggest the maker of the model was Thomas Wilby (2). His education would have covered mathematics to the degree to which he required it as a successful assistant to his father. However, I further suggest the source of his skills in modelling in cardboard may well be William Wilby, potentially a great uncle. How did Thomas’s skill in modelling come to the attention of the Exhibition Committee? Junior assistants were selected from school leavers at Christ’s Hospital School, where art was encouraged, and it seems likely City connections would have enabled this. Furthermore, but possibly irrelevant, one of the alumni of Christ’s Hospital School was none other than Henry Cole (1808-1882), civil servant, inventor, in charge of setting up the Great Exhibition, and later first director of the South Kensington Museum (now the V&A).

Although clearly very skilled, Thomas Wilby was not a professional model maker. He had the same name as his father, confusingly, but fortunately a fairly uncommon name in the small community where he lived and worked; his story could be unpicked from other archives, despite changing address and disappearing from trade directories.

²¹² Kenny, A. (2015) E-mail to Jane Insley, 19 August.
3.2 Becoming a model maker – education and training

Another initial question was how anyone discovered they had the skills and inclination to make a living making models. What instruction was available? How children (and their art) were regarded changed dramatically over the period of this thesis; availability of primary education, access to further training for entry to art school or academy, and manual or hand-eye training all have complex separate histories; I have used general histories as references for this section, notably Wardle’s *English Popular Education 1780-1975* (1976) and Blachford’s *History of Handicraft Teaching* (1961). Tracing the derivation of card crystal models helped me realise the context for modelmaking generally, and in particular during the first half of the 19th century, was far wider than I had imagined (Insley, 2017). Here I look at primary schooling, learning to draw (both by formal means and informally), training artisans and architects, architectural modelling and the training of the diorama artists as far as is known.

**Literacy and drawing**

As details of schooling of the individuals in this research are mainly lacking, this section cannot be more than context-setting. Towards the end of the 17th century, the guild apprenticeship system was not only the monopolised way of learning a trade, but also inculcated social habits. From the early 18th century, both magistrate-established workhouses and charity schools offered rudimentary education for the poor (Wardle, 1976:23). Workhouses trained children for work, becoming a hallmark for pauperism and preventing the poor from rising above their class, (Blachford, 1961:16). The alphabet and beginning to read the Bible were the most common forms of learning. By century’s end, the guild system slackened and new industrial processes formalised child labour. In Britain (excepting Scotland), ‘British’ or Nonconformist Schools from 1808 and National Schools connected with the Church of England from 1809 became more numerous, spreading primary education of problematic quality; frequently, younger pupils were taught, after a fashion, by older ones. Education provision began to shift from basic skills of reading and writing to a (state-sponsored) system of day schools, both in Europe and the USA (ibid.:18).

For the very poor, Wardle (op. cit.:47-54) described a desperate situation, of high Infant mortality, surviving children being sickly, put to work when very young, almost certainly by the age of eleven. Where schooling was offered, attendance was problematic, and children were totally unequipped to begin the process of learning. Between 1830 and 1850 at least 10% of adult unskilled workers were paupers earning less than 10 shillings
a week. Nonetheless, craftsmen from skilled trades rendered obsolete by technical innovation were significantly interested in education.

Children (mostly boys) with rich parents could be tutored at home in preparation for public schools and universities, or employment as literate, numerate assistants or clerks. Public and endowed grammar schools developed classical education methods to teach aristocrats and prepare pupils for professional life (Blachford, 1961:14). Sheila Rowbotham (1989), in her thoughtful survey of British women’s struggle for equality, *Hidden from History*, suggested that by the 1800s, education for girls was geared more towards family or domestic service. Manual dexterity was useful for cookery, needlework and so on. Higher status females would be trained to run households and manage servants, their free time occupied by pursuits regarded as suitable by society, including sketching, painting and other crafts. These in turn became seen as feminised, domesticated, unprofessional, generally of less account and therefore more easily forgotten or ignored.

The model makers featured in this thesis were probably not the poorest; without information about their schooling, I speculate that they could (more-or-less) read, write and draw. Crystal model makers appear similar to laboratory assistants (I return to this point) (thesis:164), architectural model makers were skilled craftsmen able to draw and read plans, and diorama makers were largely trained artists. For all, the ability to draw would be useful. Richard Carline (1968) looked at the history of learning to draw; Stuart Macdonald’s magisterial study *The History and Philosophy of Art Education* (1970) included similar ground. Carline (1968:12-31) recorded Richard Mulcaster, first head teacher and twenty years at Merchant Taylors’ School, as the first to note learning to draw in association with writing in 1581-2; it was not a taught subject until the 17th century, with John Dury in 1645 unusually promoting art education as training for observation. Carline attributed 17th century demand for drawing and etching instruction books to diffusion of copper plate printing from the Continent. Christ’s Hospital in the 1690s aimed to train people capable of preparing technical plans for architecture, perspective views and working designs, through the interest and effort of both Wren (during the building of St Paul’s Cathedral) and Samuel Pepys (1633-1703, Chief Secretary to the Admiralty, concerned with the expansion of trade and industry) (ibid.:35-46). Pepys also supported examinations in art for pupils who wished to become pilots (navigators trained to guide shipping safely in and out of port) (ibid.:48).

For would-be artists, training was available to children via competitions such as those organised from 1754 by the Society for the Encouragement of the Arts, Manufactures
and Commerce (later the Society of Arts, or RSA) ‘confined to young persons who intended hereafter to become artists’ – boys and girls under the age of sixteen (ibid.:50-54). Some competitors became renowned and successful artists; notably for this thesis, John Flaxman won a prize for clay modelling aged only eleven, having taught himself by copying stock in his father’s plaster cast business (John Flaxman, 2017).

Classical art schools flourished in Italy from the 16th century and France from the mid17th century; the first English Academy of Art opened in London in 1711, Sir James Thornhill (1675-1734, painter of the dome interior at St Paul’s Cathedral) being an original director (Macdonald, 1970:17-40). His son-in-law Hogarth continued it from 1735 in the sculptor Roubiliac’s workshop in St Martin’s Lane, London. The Royal Academy of Arts was set up with a teaching remit and Joshua Reynolds (1723 – 1792, portrait painter) as its first president. Any boy [sic] who was thought to have exceptional talent in art was advised to leave school and train professionally in the Academy Schools, sometimes from a remarkably young age (Carline, 1968:58).

Self-help / home learning

One example of self-help or home learning can be seen in the making of card crystal models by cutting and folding a drawn expanded layout into a crystal shape. In 1840 a seminal work describing this reproduced layouts at very small scale – the reader had to be able to copy and scale up the drawing to finish the piece (Anstead et al., 1860). The existence of such a book (an ANT immutable mobile) implied that interest, drawing ability and manual skills were reasonably available amongst its intended readership, the artisan classes (Plate 25).

The 1835 Select Committee noted the educational value of steam-powered printing, enabling circulation of cheap art publications and reproductions of paintings (Porter, 2000:72-95). Poorer classes could only cultivate artistic instincts by practising a craft; reproductions extended the availability of pictures into the home (Carline, 1968:77). From the beginning of the 19th century there was also a flourishing trade in instructional manuals for young people; one series was Pinnock’s Catechism, over 100 titles on a wide variety of subjects in cheap pocket-sized booklets.

Significantly for this thesis, modelling with paper, card or pasteboard was also extensive; the art of paper-cutting was widespread in Europe. The preface of The Art of Working in Pasteboard (3rd ed., 1831) remarked:

213 Lawrence, Landseer, Millais and Cotman
Plate 25

1. Page showing net for crystal making [MNHLib]
   2. Detail - the diagram is about 2 in wide

3. *Pinnock’s Catechism* [NAL]
4. With a business card for scale

5. Instruction in modelling buildings in card for children, 1830 [NAL]
   6. and for architects, 1859 [NAL]
The celebrated seminary of Schnepfenthal, near Walterhausen, in the Duchy of Saxe Gotha, founded in 1784 by the late C G Salzmann, was the first German school that adopted the very judicious plan of combining some easy manual art with the usual branches of education. Mr B H Blasche, one of the professors of that seminary, published in 1805, in one volume 8vo of 420 pages, his Art of Working in Pasteboard, which in 1811 had gone through four editions (Blasche, 1831, unpaginated preface).

The English version was based on Blasche’s work, but in a blatant piece of rendering sources invisible, this was not acknowledged by either the publisher, T and T Boosey, London, or translator, Daniel Boileau (himself only acknowledged in advertisements at the back of the book for other works in the sequence) until 25 years after the original publication (Insley, 2017). The mature publication successfully ran to several editions, implying enthusiasm for the activity amongst (the parents of) children with leisure time or a desire to learn. As seen, fine examples of card modelling were exhibited at the Great Exhibition (Anon., 1851:828-843).

Examples cited above show artists or craftsmen acquiring skills informally in childhood and embarking on successful careers. Literary and philosophical institutes provided gentlemen with venues for informal learning; artisans being barred, mechanics’ institutes grew up to meet their demand for learning and improvement. Over 2,000 people attended the inaugural meeting of the Mechanics’ Institute of London in 1824 (Adamson, 2013:127). The crystal model study includes examples of entrepreneurial people supplying to this market. J J Griffin wrote texts explicitly for his ‘fellow’ mechanics, and supplied apparatus to schools and individuals; Larkin made models to patterns designed by Haüy and Jameson, advertised as a mathematics teacher, and employed prestigious and well-informed engravers for his own textbook.

**Training artists**

Competition with foreign manufactures with more evidence of design than in Britain and industrial expansion led to manufacturers’ demand for ‘a system of art teaching that did more than just show the pupil a number of technical tricks for representing distance, foreground, skies or reflections’ (Carline, 1968:75). Nationally, art education included the need for industrial design as well as landscapes and portraiture; goods formerly hand-made were mass-produced by machine. However, there was widespread concern to maintain artistic quality. Following investigations by a House of Commons Select Committee in 1835, the state began to sponsor practical art education, founding a School of Design in London in 1837.
Art training was provided to a few by the academies. In 19th century Academy schools, the teaching could be less than inspired; W P Frith, (1819-1909, painter of social scenes in the Victorian era) attended Sass’s Academy in the 1830s and then the Royal Academy school, complaining later that artists tended to turn to teaching if unsuccessful in selling their own art. Supplementing income by teaching could be a welcome part of the artist’s profession, and teachers such as John Varley were much in demand. John Sell Cotman’s livelihood apparently depended entirely on teaching, despite lacking any art instruction in his youth. Students paid for tuition, at both day and evening classes; however, the wearisome conventional drilling of the exercises they had to perform led to complaints. They began by drawing outlines, then shading, copying from prepared drawings or prints; drawing from life was kept for the advanced classes. Items to be copied initially were geometrical shapes – cubes, spheres, cones, cylinders and hexagonal prisms (visually similar to crystal shapes) (Carline, 1968:65-79).

Henry Cole, a civil servant in the Records Office, was massively influential in improving provision. Delayed by having responsibility for the Great Exhibition, he aimed for a branch school in every main provincial town, their number increasing from twenty in 1852 to three times that number within twelve years. In 1852, Cole announced three objectives – to train teachers of drawing at elementary level, to train masters for provincial art schools, and to provide training in technical arts for industry. Local institutions for art education and technical schools would be linked wherever possible with mechanics’ institutes or other educational bodies; the School of Practical Art trained the teachers. For a minimum number of paying students, the government guaranteed the teacher’s salary, and provided required materials at half the cost price (ibid.:81-82).

Training artisans

Necessary goods were made in workshops of all sizes long before the steam engine, but machine-assisted manufacturing speed was greater than by hand alone. Animal, wind and water power were all harnessed to some of the heavier labour processes. How production was organised depended on the relationship between masters and workpeople, capital to pay for equipment and materials, and how finished goods reached market.

Blachford (1961:23) took the story to the end of the 19th century in a mere 10 pages, at which point he introduced Swedish Sloyd, a Scandinavian form of handicraft training. More usefully, Gertrude Williams (1957:1-10) included history in her study of recruitment to skilled trades. Until the beginning of the 19th century, one entered trade or industry by apprenticeship, established by the Statute of Artificers of 1562 and not repealed until
1814, long after it ceased to be effective. The master took the boy to live with him, for
seven years of servitude, teaching him first to become a journeyman, later a master.
The boy undertook to serve for a fixed number of years for much less than an adult’s
wage. Masters could take on young people as required without written or even oral
agreement. The Statute did not apply to ‘new’ trades, so 17th and 18th century
developments were not covered; an estimated 99% of journeymen employed at the
beginning of the 19th century were working outside the Statute.

With increasing mechanical processes, approved training became confined to only a
few trades requiring both skill and understanding. Where no tradition remained,
journeymen could introduce their sons to crafts without indenture, training, conditions or
regulation. Regulations (by custom or trade union) controlled entry to trade and
protected skilled workers from competition, but were not fully effective. It became both
more difficult and less necessary to get training as much work did not require it. Self-
improvement for artisans by on-the-job training became more problematic. Semi-skilled
processes in large-scale production could be learned quickly; youngsters could work for
a couple of years, being replaced by even younger ones when they requested better
pay. Factory Acts from 1801 onwards and Education Acts from the 1870s excluded
children from factories and raised the school leaving age, but offered little protection
from exploitation.

Forty (1986:34-36), analysing the history of industrial design, took Wedgwood’s pottery
as an example of an industry using modelling. When manufacture of pots was broken
down into processes carried out by different people, preparing instructions for others
was inserted as a design stage. By the 1750s, modelling was recognised as a separate
activity, done by individuals called modellers, solely responsible for making prototypes
for copying. Mass-produced uniformity being important and individual variations
eliminated, the modeller’s value to the entrepreneur increased, calculated as the fraction
of the work removed from each craftsman making a single pot, making modellers the
most highly paid employees in the potteries. In 1775, aged 20, and a student and
medallist at the Royal Academy specialising in sculptural relief, John Flaxman worked
freelance for Wedgwood at a rate of a guinea a day preparing designs; in comparison,
skilled craftsmen were paid between seven and twelve shillings a week. Modellers’
value was even higher when Wedgwood adapted his pots to new styles and fashions for
the emerging middle and upper classes. Working-class provincial craftsmen could not
but be ignorant of these fashions, although their skill was required to create them.
Wedgwood believed finished pieces demonstrating Academic training and cultural
sensitivity were valued and rated more highly by his customers. A professional designer could design a stylish commercial product, enabled by the factory’s division of labour.

For crystal model making, skill was required for working wood, plaster, terracotta, artificial stone, or metals of various kinds. The scientist chose the finished form, which may have depended on copying a pre-existing natural specimen. Intermediate stages included both drawing and modelling. Romé de l’Isle’s printer asked for models to copy (thesis:69). Sizes of models and images in plates match, lending credibility to the idea that the model was copied from the plate (for instance, for Jameson’s texts, Larkin having approached him to announce the availability of copied models). Griffin in Glasgow in the 1830s had access to local potteries which could have worked from moulds, but whether he used them or bought in expertise from further afield is unclear. Whoever the actual creators of the models were, they needed to be able to copy exactly, whether producing drawings or moulds first themselves or being provided with them. Artisanal training was implied – there was no room for artistic originality. For the autodidact, making one’s own cut-out crystal models from plans copied or not, the development of skill in the absence of formal education lay through informal routes such as mechanics’ institutes and self-help publications. For copying or enlarging plans to be cut out, a facility for perspective or geometrical drawing was necessary.

Training architects

Kaye, in his still useful 1960 sociological study of the architectural profession in Britain, remarked an architect had to be both technician and artist, producing something whilst meeting aesthetic criteria (1960:22-31). Kaye somewhat idiosyncratically divided the art world into Pure Art, Quasi Art, Applied Art and Non-Art, based on how the work was judged. Attitudes during the 19th century shifted architecture from being an Applied Art to Quasi Art; the artistic architect had artistic autonomy, but the professional architect needed clients. Tracing architecture’s early history, Kaye noted master masons of the Middle Ages, introduction of the Office of Works as an Elizabethan department of state, and cited Inigo Jones (1573-1652) as the first to see a building as a work of art (the Queen’s House in Greenwich). The value of using a model before building was suggested in Wotton (1664):

> Let no man that intendeth to build, setle his Fancie vpon a draught of the Worke in paper, how exactly soever measured, or neatly set off in perspective; and much leffe vpon a bare Plant thereof, as they call the Sciographia or Ground lines, without a Modell or Type of the whole Structure, and of euery parcel and Partition in Fastboard or Wood. Next that the said Modell bee as plaine as may be, without colours or other beautifying, lest the pleasure of the Eye preoccupate
the judgement. [He then quotes the example of a model of St Peter's in Rome by Labaco, some 22ft long, costing the price of] a reasonable Chapell; Yet in a Fabrique of fome 40 or 50 thousand pounds charge, I wish 30 pounds at least layd out before hand in an exact Modell; for a little misery in the Premises, may easily breed some absurdity of greater charge in the Conclusion.214

At Wren's time, gentlemen architects were few; Wren helped set up a school for builders and craftsmen (thesis:148). Subsequent amateur architects were hugely influenced by Palladio’s classical architecture (1570), but had uncertain status. Kaye quoted Roger North (1653-1734):

For a professional architect is proud, opiniative and troublesome, seldom at hand, and a head workman pretending to the designing part is full of paviour vulgar contrivances; therefore be your own architect, or sitt still (Kaye, 1960:47).

Architects had diverse backgrounds and social origins; training, by pupillage or apprenticeship in an architectural office, was neither obligatory nor regulated, and there were no professional associations. Kaye quoted George Dance the Younger (1773), who described typical training consisting of tuition to age 15 in drawing, writing, arithmetic, geometry, Latin, Greek and French. The student was then articled to an architect who was given a premium, for training consisting of two years mensuration of artificers' work, plus drawing the design, plans, sections, elevations, instruction in mechanics, hydraulics and perspective, sometimes in French. Foreign travel could include visiting sites of antiquity in France and Italy (a Grand Tour), returning home aged 22 or 23 to begin business. However, the student would still know nothing of materials (their nature, use, value), tools used in building and the practical work of bricklayers, carpenters, masons, plasterers, plumbers and glaziers.215 The architectural historian Martin S Briggs, selecting 24 architects to represent the 18th century, noted three were trained by their fathers, fewer than half by practising architects, and the rest stepped up from positions as clerks of work, masons or carpenters, or had been painters or sculptors.216

An 1869 editorial in The Architect gave a similar perspective on the state of architectural education at the mid-19th century. ‘Thirty years ago’ (ie the 1830s), six years of pupillage included line drawing and practical work. The first two years consisted of mainly drawing the Five Orders of Architecture, and copy drawing, lined, like engineering drawings of the day with shadows traced, and colours added carefully, unlike the present ‘flashy

coloured perspectives – mere tricks and shams.’ Then, buildings were classical in style, with little use of iron in construction; by the time of the editorial there was so much more to know, with current training being three years of articles; ‘only a trifling proportion of pupils ever do continue their studies in the evening hours’; ‘learning true architecture by the careful delineation of old buildings is almost entirely out of the question’.217

Small but increasing parts were played by the RSA offering small prizes for designs, the Royal Academy giving a route to royal patronage, the exclusive Architects’ Club founded in 1791 and the London Architectural Society founded in 1810. Sir John Soane became the Royal Academy’s first professor of architecture, turning his London property into a library and museum as well as a school for architecture students.218 The London Architectural Society aimed from 1831 to provide facilities for students, merging in 1842 with RIBA.219 Kaye noted beginnings of professionalism, due to factors including the slow development of capitalism and the emergence of architect-as-artist self-consciousness, separating the ‘master mason’ from the scholar designer who knew the latest fashions. Concern also grew to demonstrate public probity in the face of speculative building, and so improve public status.

There was still room for self-improvement. In 1862, The Building News ran a series of articles on ‘The Home and Out-Door Education of Artist Workmen, their proper Work, and the Way to Do it’.220 The aim was ‘to supply to artisans a means of information and communication not before open to them’, to show what each man [sic] could do for his own improvement and progress through reading and books, by out-door influences and the study of work in museums and buildings. Problems identified included the fact that most important buildings were closed in the evenings, the only time a working man could visit.

We shall always contend that the artists and workmen of our own day are just as able and as capable of being taught as the artists and workmen of old, and that their work differs not from incapacity but from defective teaching, or no teaching, or false teaching, or absence of fair opportunities, and the needful time. No work of art is possible without TIME for it, and this now is always denied! 221

There was a further discussion of the difference between workman and artist:

There is in truth no dividing line between the workman and the artist, but that the difference is one of degree not of kind. All know there is a great gulf fixed

218 Thornton and Dorey (1992); Kaye (1960) ch5.
219 The Institution of British Architecture was formed in 1834, receiving a Royal Charter in 1837.
221 The Building News 1862, 29 August, p.152.
between the mere workman and the designer: they are as far apart as the poles. No one supposes the artist to be a workman any more than the workman is thought capable of becoming an artist, or doing artistic work. But the world is wrong nevertheless and the wrong is the real cause of the absence except by accident of real art work in these modern times. The artist is now above being a workman, and the workman is always below the lowest artistic level.\textsuperscript{222}

Emphasis was placed on drawing skill being transferrable to the material of the workpiece – ‘Whether this system of drawing is to be of use to you or no depends wholly on what you intend to do with it when learned’.

A notable absence was any mention of training to make models.

**Training architects to model**

Formed in 1847, the Architects Association suggested a curriculum for professional examinations in 1855, and held the first in 1863. Making models appeared alongside carving in 1861, but of human figures rather than buildings. Richardson (1859:iii), claiming to be the first to write a book on the art of architectural modelling in paper, may have been correct, even though children had been producing paper model buildings for decades. Displays of fine building models in the Great Exhibition (1851) Sculpture section some eight years previously showed the ability to make such things was fairly widespread. The skill was there, but unmentioned and less valued compared to later 19\textsuperscript{th} century French Impressionism promoting expression.

Models appeared from time to time in the press. In 1863, following the series on workmen’s informal studies, *The Building News* noted an exhibition of card models by Mr Ashton of Sloane St, London, including one from the *Great Exhibition* and another shown in the International Exhibition of 1862.\textsuperscript{223} A few weeks later, there was a report of a model of Armagh Cathedral designed by Mr Duff, architect, but made by Robert H Sling, hairdresser, in his spare time. The model measured five feet by two feet eight and a half inches by three feet eleven inches tall, made from carved wood, and, complete with bells, 76 stained glass windows and 3,213,543 ‘apparent stones’, was intended to be shown at the Paris Exhibition of 1864.\textsuperscript{224}

In 1867, under the heading of ‘The Art Student – Architectural Modelling’ *The Building News* reported:

\begin{quote}
Some years ago it was the custom when a building of any importance was designed to have the effect shown by a model. Latterly, owing perhaps to the
\end{quote}

\textsuperscript{222} *The Building News* 1862, 19 September, p. 213.
\textsuperscript{223} *The Building News* 1863, 18 September, p.721.
\textsuperscript{224} *The Building News* 1863, 30 October, p. 825.
development of perspective drawing and to the expensiveness of models, the practice has been discontinued, and drawings are considered quite sufficient to convey an idea of the intended structure. Perspectives are notoriously cooked; a gable is brought out here, and a pinnacle set back there, until the pretty pictures one sees in architectural exhibitions and competitions are often anything but correct representations of the intended buildings.\footnote{The Building News, 1867, 6 December, pp. 851-853.}

The report continued, remarking that perspectives gave only one point of view, whereas models allowed the spectator to:

walk round, see it on every side, come close and look into the little porches and recesses; go back and see the general appearance, move his eye along and judge of the effect of altering the perspective, and if it will help him, raise himself and take a bird’s eye view of the roof. Then again, though it is true that ‘cooking’ is possible in modelling as in most other things, still a delinquency in this respect is much more easily detected than in a perspective.

Two follow-up articles gave instructions for model construction.

The models created for St Paul’s Cathedral during the second half of the 19\textsuperscript{th} century were produced by sculptors such as Stevens (of the Wellington Memorial) or by architectural assistants (Whellock, Allen) working for the lead architect at the time. Trade directories showed a number of people offering professional architectural model making; the Cathedral had the skills on site for its own needs, by association if not on the paid staff. The Surveyor of the Fabric’s office was the responsibility solely of the Surveyor, leaving little detail or archival evidence in Cathedral holdings. The survival of other records concerning its inner workings is also problematic; some Penrose papers survive in the RIBA archive at the V&A, but they tend to be of a more personal nature or concern other architectural interests.

The value of modelling as a tool for architecture arose again in a number of articles at the beginning of the 20\textsuperscript{th} century. Usually the value of a model over a perspective drawing was emphasised, highlighting potential problems in advance of the build, along with the opinion that clients were often unable to appreciate architect’s technical drawings (elevations and sections), and could be misled by perspectives. Berthold Audsley (1914) helpfully explained the use of different scales of model at different stages in the design process, and for different purposes once complete. One example cited earlier (Plate 26) was of:

a miniature – scale $\frac{1}{4}$ foot to 1 inch – built for a model engineering firm in London, England, showing a beautifully laid out private estate, with a miniature railroad running round the grounds, such as is seen in many of the large estates
Model estate, for ordering parts for garden railway, *Brickbuilder* 1914 [RIBA Lib]
abroad. This miniature shows a fine English house, with its surrounding lawns, garage, greenhouse, tennis lawn, lake, river, and with a very beautiful little Japanese tea house in the center of the lake, with a little bridge joining it to the garden. This miniature was built to illustrate more fully the different accessories needed for such a miniature railway, which would be one quarter full size, or 15-inch gauge, and, as they were perfect reproductions, the miniature was used to order from instead of keeping the different parts in stock.  

Rook (1918), Hirons (1920) and Gauthier (1926) all gave detailed instructions in model making. Rook discussed tools, and how to mix plaster; Hirons wrote about liaising with an architectural modeller during the design of a building; Gauthier paid tribute to a series of articles by Corbett four years earlier on modelling in card, and focussed instead on plaster. A training scheme for architectural modelling was set up at Columbia University (NY) in 1920, the Director of the Architecture School being William Alciphron Boring (1922:200-202). Modelling in architecture was experiencing a high point at this time.

Training diorama artists

Making dioramas emerges as a niche speciality in three-dimensional art. Many of the Science Museum diorama makers (Roussel, Cawood, Rooke and Dinkel) trained as artists.  

Gordon Whatman studied at Norwich school of Art and Brighton College of Art before moving to London.  

Henry Broun-Morison studied architecture and sculpture with Henry Wilson, going on to become Master of Design at Birmingham Municipal Art School.  

Tom Ivester-Lloyd was mainly self-taught, having found he could draw horses better than his school teacher.

However trained, the diorama makers were mostly known in art circles for other art activities. For some, the dioramas would for a while be their main source of income, either through the Imperial Institute, or the combination of Institute and museum commissions. However they all could draw (both accurately and expressionistically, as examples in the object files demonstrate), were skilled enough to be employed by the Museum more than once, and several held teaching positions in art schools and elsewhere. Dunstan Mortimer’s letter heading described him as a scenic artist in 1958, prior to working with Roussel on the Shipping Gallery. Whatley, Black, Roussel and Rooke all produced posters; Louis Duffy’s background is not known, but anecdotal

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226 Audsley (1914). Mentioned again in Hobbs (1925) as being made by himself, working at the English model making company of Bassett Lowke; (thesis:100).


229 Genealogical information from Mrs Fiona Davie, local historian near the family estate at Finderlie in Scotland.
Science Museum evidence relates he taught one of the museum’s designers, and his museum work was post-retirement. Hugh Gee worked in films, Ian Robertson went on to design book covers, and Carter had visited Australia before joining the Imperial Institute.

3.3 Being a model maker

A model maker rarely leaves a trace in history before completing their education or training, of whatever nature, and starting work. Some, such as the crystal model makers working with Haüy, had this work thrust upon them; Larkin in London saw an opportunity in Jameson’s writings and seized it. Some model makers were clearly more successful than others; most were ready to diversify to make ends meet. Specialist architectural model makers needed a certain size of client base to have a sustainable concern; if employed in-house by architects, they remained invisible except in unusual circumstances. The diorama artists trained as representational painters and sculptors, and worked as such if diorama work was not required; some did not highlight their diorama work. So what was it like to be a model maker? In the absence of their own records, it is occasionally possible to sense some aspects of their business proceedings. Trade directories show how they advertised their work in their descriptions. How long they stayed at a given address is an indicator of stability. From the names of their businesses, it is possible to surmise partnerships and successions; when entries were enlarged to give more information, they advertised details of the kinds of goods and services they were able to offer. How successful were they? How were they regarded, by themselves and by their clients?

Direct information is scarce. This section considers how makers defined themselves, how they were seen by their institutional clients, examples of status anxiety, contributing factors to success in business, and the dichotomy between craftsman and artist. Institutional attitudes to models and their use in the collections by the Science Museum is considered, and factors leading to invisibility for the makers.

How they thought of themselves

Crystal model makers left few written records, so it is difficult to know directly how they saw themselves. For those working as assistants to the holders of academic positions, like Beloeuf and Carangeot in Paris, it is tempting to assume they were less well-off than their masters; Beloeuf was described as a journeyman, and a skilled one, initially living at work (thesis:69); Carangeot wrote gleefully about himself as a seeker after instruction from Romé de L’Isle but without giving details (Burke,1966:70). For Larkin and Griffin, who also wrote accompanying books, (arranging) model making was only
part of their activities. Larkin (1820) described himself as a teacher/tutor. Griffin (1941), supplier of educational apparatus, explicitly offered help to fellow mechanics with an interest in crystallography. Neither gave any insight into methods used to generate their crystal models.

For architectural model makers, trade directory searches were more helpful. From the catalogue of the Great Exhibition, of the 58 people responsible for 53 entries involving models of buildings or monuments, none described themselves as an architectural modeller. Their descriptors included maker, producer, modeller, manufacturer, proprietor, designer, inventor, artist and, in one case, gardener. The trade directories showed not all were model makers by trade. William Bardwell was an architect, James Barritt a cabinet maker, and Thomas Wilby (maker, cardboard model of St Paul’s cathedral, detailed elsewhere) junior renter at St Bartholomew’s Hospital. James Frewer (designer and manufacturer, Gothic conservatory) reverted to his more usual description as a plumber, painter and glazier in directories between 1843 and 1854.

The earliest directory references for which an 1851 exhibitor could be identified with confidence were in 1838, four names appearing that year being a papier maché and paper ornament maker, an architect, a sculptor and modeller, and one ‘modeller’ (Thomas Day). Through the entire period of directory searching, to 1991 when printed volumes ceased production, there was overlap with allied trades – sculpture, masonry, plaster of Paris manufacture, composition ornamentalist and projecting letter maker (Chillingworth, in 1858), and various versions of modeller, model maker and architectural modeller.

Changes from one category to another may indicate where the maker felt there might be better business advantage. Some switched from specialist to general modelling, others the reverse. George Bartlett was a modeller in 1839, modeller architectural in 1840, modeller, general from 1841 to 1858, and again from 1860 to 1862 when he finally reverted to Modeller, architectural, retaining the distinguishing symbol for this speciality until 1883, possibly reflecting where he saw his potential client base. One significant overlap came with those turning to architectural modelling rather than continuing training to be architects themselves. The stand-out example is John B Thorpe, who trained with Lutyens and Scott, then turned to modelling and founded the longest-lived modelling practice in this study. Thorpe went on to make a famous model of Liverpool Cathedral.
for Lutyens (thesis:98, fn 146); the company was called back to restore it at least twice.²³⁰

Longer than single-line entries sometimes gave more detail of the professional offer. Edward Ashenden, *model maker, architectural*, offered dioramas, models and displays; examples of his diorama work are in the Science Museum, London. Francis Bernasconi was Plasterer to her Majesty in 1838, being described in *Mapping Sculpture* (2011) as a highly successful stuccoist and architectural modeller. The Mabeys supplied monuments and tombs to order, according to entries from 1883 to 1891, adding sundials in 1893.

Roussel insisted he and his fellow diorama makers should be acknowledged as the trained artists they were, and fought their corner in his business practice, including who might be allowed to refurbish their work (thesis:112). Why he felt so strongly about this was unclear; but when he had not stipulated it, they went unnamed. By comparison, from 1919, Charles Bean, founder of the Australian War Memorial, Canberra, sought out and publicly monopolised the best artists to be memorial diorama makers (Back and Webster, 2008:6).

Checking correspondence addresses found in Science Museum files via directories such as the POLD gave mixed results. The Street Directory section gave an occupant’s trade; the Residents listing would be a cross-check on whether the address was likely to be used for work. The Commercial Directory section listed names in alphabetical order, giving trade or profession, and the Trade Directory section would group names of people using the same descriptor. Those few diorama artists listed in trade directories chose their category. Roussel, Cawood and Dinkel appeared under ‘Artists’ (a category taking nine columns of the directory pages in 1931, going down to two in 1943 as an effect of the war), Dinkel adding ‘ARCA’, his qualification. Ernest Whatley does not appear in the directories at all, perhaps being a full-time employee, with sufficient work. Similarly, G N Morewood had a private correspondence address, but no trade entries. Dunstan Mortimer was routinely entered as a commercial artist, at 66 Strathbourne Road. Hugh Gee, working for the Children’s Gallery in 1931, entered his company name, Art Directions Ltd, under ‘decorative designers’.

In 1935, Ashenden appeared as ‘artist’ in the Street directory entry, but was also included under ‘Commercial artist’ in the Trades section, at an address shared with two other artists and two stained glass artists. Cawood became the lead name at 2 St

Oswald Studios in 1927, and deliveries of fittings to and dioramas from that address show the premises were shared with Whatley, Rooke and Roussel as required. The demand for dioramas made by the Roussel group was sufficiently large to merit its own premises apart from the Imperial Institute; Cawood kept the address until 1956.

**How others saw them – institutional clients**

The makers of crystal shape models, skilled artisans or students of chemistry, are analogous to laboratory assistants of the 17th and 18th centuries. Academic attention to these largely un-named people enabling experimental work includes Shapin’s (1989) description of Robert Boyle’s 17th century laboratory practices, showing how he relied on his assistants whilst denying them knowledgeability. Described as ‘servants’, they were male, engaged for a period to live in the household and perform physical tasks as required, with at best some degree of manual skill. They were present, but unremarked; Shapin noted their relative ‘transparency’, both to Boyle in his experiment reports and historians subsequently, with a fundamental distinction between the value of what they did and the authority of their employer (1989:556). One notable exception was Denis Papin, a medical graduate and published author of a scientific text before working for Boyle, and whose subsequent visibility relied on the fact that, despite the master-servant relationship between them, Boyle trusted Papin (Shapin, 1989:561). One of Shapin’s illustrations shows Lavoisier’s late 18th century chemical laboratory, taken from a late 19th century work (ibid.:560); the image clearly shows Madame Lavoisier recording results at the right and a technician carrying equipment at the left. Shapin’s point was that in a ‘recent collection’ of scholarly essays using that image for the cover, Mme Lavoisier was retained, but the technician was cropped. A Wellcome Institute diorama from the 1930s based on the same image included both figures (Plate 27). Arguably, the sensitivity of the diorama makers in the 1930s was greater than that of more recent historians of science. Shapin went on to note that modern technicians working in laboratory settings still sometimes feel as invisible as their forebears.

The makers of models for Romé de L'Isle in the 1780s and for René-Just Haüy in the 1810s in France experienced similar master-servant relationships. As documented by Touret and Saëjs, the connection was economic, although, like Papin, some assistants may have also been students. Carangeot, Romé de L'Isle’s assistant, whilst producing template models in clay (arguably more forgiving to shape than wood), devised a new

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231 SCM A626414.
Lavoisier's laboratory diorama, including Madame Lavoisier and the servant [Wellcome image]
scientific instrument, the angle-measuring contact goniometer, from a tool used in porcelain potteries, thus unusually achieving greater visibility and personal recognition, and later sharing credit for discovering the crystallographic Law of Constancy of Interfacial Angles. Haüy’s crystal model makers were treated as joiners, skilled artisans without intellectual input to what the models represented. After Haüy’s death they continued making models to his patterns commercially, but without making innovative mineralogical contributions. Löscher, hand-carving wooden crystal models to Wemer’s patterns, needed both patience and manual skill. An up-and-coming successor to his mentor, he published the works from which these sets were identified. Griffin’s porcelain models were offered through catalogues of apparatus and equipment for teaching institutions; the only sets presently known date from a ten year period mid-19th century, so were not widely taken up. Griffin was not mentioned in Schuh’s monumental Biobibliography of Mineralogy; Kjellman, surveying existing model collections, remarked he had never seen any other examples, suggesting Griffin had little impact in mineralogy or crystallography. I argue his main contribution was bringing science to wider audiences rather than pushing back its boundaries (thesis:55-59). Jameson’s endorsement of Larkin’s models was somewhat half-hearted, describing Larkin as an ‘artist’, one of (unnamed) many, making models to facilitate crystallography studies. Larkin himself claimed to supply models to Mawe, Jones and Bate in London (the latter two were well-established scientific instrument makers, the former a mineralogist, also mentioned by Delvalle Lowry). He described himself as a teacher of crystallography and mathematics in his 1820 book on solid geometry; making models was not promoted as a major concern.

The diorama makers saw themselves as artists, nearly all with formal training, and/or teaching art in some capacity. They were referred to as artists by The Times journalists reporting new dioramas at the Imperial Institute and other London institutions. Science Museum staff at various times referred to them as artists, scenic painters or diorama makers; their main concern was production of dioramas rather than attributions to the makers. In Whatman’s first appearance in museum records, the file noted ‘the artist has the traditional shortage of cash’, soon resolved by employment as a full-time illustrator, and eight years later becoming the museum’s first exhibition officer. So the museum viewed the makers as a source of desirable exhibition content, but without necessarily having high social status. One notable exception was Henry Broun-Morison, a Scottish baronet.
Status anxiety – Farmer and Brindley

Within manufacturing trades and professions, there were also hierarchies. Cannadine (2000:19) cited three ways of stratifying society – unitary (everyone is on one scale from top to bottom); binary (the group divides into ‘them’ and ‘us’); and a three-way version (higher, middle, lower).\(^{232}\) The guild system introduced the idea of the master of a trade leading his apprentices and journeymen, offering protection and training to craftsmen and maintenance of standards. Wedgwood, for instance, began his own pottery having been an indentured apprentice to his elder brother, then partner in two other potteries (Lucie-Smith, 1981:193). When division of labour changed piece rates, his more skilled workpeople argued for a higher wage than the labourers. When the possibility of external designers arose, Wedgwood found it less unsettling to hire in expensive expertise than employ it full-time with resulting unrest amongst the workforce (Forty, 1986:34). Tellingly, the architect Robert Adam confided in 1754 to his brother James that he was embarrassed to be seen drawing or with a pencil in his hand lest he be seen as a tradesman rather than a gentleman, although by the end of the century he was renowned for his exquisite draughtsmanship and published lavish books of his drawings for his elite clientele (Adamson, 2013:18).

William Brindley experienced similar unrest in his own workforce, having risen from stone mason to head of one of the largest architectural suppliers in London by the end of the 19th century.\(^{233}\) Farmer and Brindley were first noted working together on two Dorset churches for Sir George Gilbert Scott (Woolland in 1856 and Cattistock in 1858), becoming partners in 1868 and having a long and extremely productive relationship on over a hundred buildings (Hardy, 1993).\(^{234}\) The history of Dorset churches has been studied in detail by Joan Brocklebank (1979); her work illuminated more examples of methods of invisibility, from ecclesiastical authorities.\(^{235}\) Between 1856 and 1880, 173 Dorset churches were renovated or rebuilt, according to newspaper descriptions of (re-) consecration ceremonies. Articles usually included details of exactly what repair and replacement work was done, named craftsmen and funders, and described celebratory events and services. One of these reporters was Thomas Hardy, who trained as an architect before becoming better known for novels and poetry. In contrast, of the historical leaflets produced by the churches themselves, only two of 173 mentioned the

\(^{232}\) Quoting R Darnton’s sociological description of Montpellier, France, in 1768.


\(^{234}\) My thanks to Holly Trusted, Senior Curator, Sculpture, and Milica Budimir, Office Manager, Sculpture and Ceramics & Glass, for bringing this paper to my attention.

\(^{235}\) My thanks for this reference go to the staff in the V&A Sculpture Department and its associate, Ann Compton.
workers. Brocklebank remarked on the dust cover of her book, ‘The builders and architects, and above all the artist craftsmen, responsible for the work are a forgotten breed … A few are well known … but the majority … have only their work as a memorial’. Woolland Church was consecrated on 11 Dec 1856, but incurred another form of potential invisibility. Apparently, the patron wanted to keep the church for himself, so unusually there was no glowing description of the ceremony in the paper, the ‘only instance which has been found in doing research for this book of an unacceptable form of financial patronage’ (Brocklebank, 1979:19).

Farmer and Brindley’s partnership flourished, more public buildings featuring their work. For St Paul’s Cathedral, they prepared thirteen statues and other items, including a reredos for the high altar later destroyed during World War II. They produced terracotta models for the Natural History Museum, and work for the V & A, National Gallery, Oxford University Museum, Palace of Westminster and St Pancras Station (Rogers, 2008). Their stone yard and showrooms were in Westminster; architects and artists were welcome visitors. They made an architectural model of the Albert Memorial for Sir Gilbert Scott (displayed in the V&A’s British Galleries), and later, statuary for it. The label attributed the sculpture groups to Henry Hugh Arnstead, and the paper mosaics to Antonio Salviati, giving dates for both; no dates were given for Farmer and Brindley, a curiously modern kind of official forgetting by present-day museum staff.

After Farmer’s death in 1879, Brindley took over the business, diversifying towards import and supply of decorative marbles for the Gothic Revival in architecture (when this went out of fashion, the firm declined). Remarkably, Brindley tracked down stone quarries of antiquity, to see if they could be brought back into production. In this, he was spectacularly successful, the stone yard containing a museum of samples artists could consult (Hardy, 1993:11). The Builder of 12 May 1888 reported a Saturday afternoon visit to the marble and stone yard by members of the Architectural Association. They were shown around by Mr Barnes, the invisible Mr Brindley being away in Spain; items in production included a white marble credence table for St Paul’s Cathedral, to the design of Bodley and Garner (ibid.:13). Edward Burne-Jones studied marble there for his painting *Avalon* in 1891 (Burne-Jones, 1906).

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237 Exhibited in 2015; Physick and Darby, (1973) V&A Catalogue No 150, noted by Hardy, p. 8. The model was dated 1863 (Albert died in 1861, and the monument was erected in 1876) and it had been displayed in the Paris Exhibition of 1867 before being sent to the South Kensington Museum.
238 *The Builder*, 1888, 12 May, p.342; the credence table does not appear on the cathedral database.
A brief description of Brindley’s interests appeared in the Building News in 1890; he was a Fellow of the Royal Geographical Society, and lectured on marbles to the RIBA and the British Association. The article finished by remarking ‘Mr Brindley is assisted in his large art establishment by a very able staff, with whom he has always worked most harmoniously’. As this seemed a strange thing to say, it was worth digging a little further to see what might be at the bottom of it. Again, The Builder had more information. In August 1873, the unions for master builders and for carpenters organised a strike for an extra ½ d. per hour on their normal wages, then between 8¾ d. and 9½ d. according to skill. Farmer and Brindley remarked that they already paid higher rates, but were prepared to counter-offer a flat rate of 9d per hour. The strike was a week old when The Builder reported; it did not last long, but clearly the event still rankled in 1890. Another useful insight in the same report was a rare indication of the size of the enterprise. About 100 of the striking carpenters worked for the two largest companies, Farmer and Brindley and Robinson’s, suggesting about 50 were employed at Farmer and Brindley. However, the main output was stone; the masons (meeting in a different public house a short distance away) must have also been fairly numerous, given the amount of work the company handled.

The company exhibited at the Arts and Crafts Exhibition Society in 1893, controversially contravening Society custom by failing to name individual craftsmen. Anonymising individuals seems to have been company policy. As Hardy remarked, there are no surviving company archives; names of individual craftsmen rarely become known. It was unusual and difficult for decorative carvers to rise to the status of artists – ornamental sculpture and its practitioners were held in low esteem. Their work required them to be highly mobile, and mostly remote from sources of anything other than rudimentary instruction. Study had to wait until they had served their apprenticeships and could move to London (Hardy, 1993:15-16). Brindley having made this transition himself, it seems odd that his management practices perpetuated the invisibility of his workpeople.

A long business life can be seen as one indicator of success; Farmer and Brindley succeeded through diversification (thesis:145). However, success was not always easy. Thomas Dighton was a 19th century maker subsisting on architectural modelling alone (Moon, 2005:145). As ‘artist’, he exhibited three model buildings at the Great

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239 Building News, 1890, 11 April, p.533.
240 The Builder, 1873, 16 August, pp.651-2.
241 The Builder, 1893, 7 October, p.254.
Exhibition, appearing in trade directories between 1844 and 1872. In 1872 he married, and may have moved to Devon, where he died in 1882. Census returns described him as an artist and/or architectural modeller up to 1881, when he was described as a retired Army captain. In 1848, The Builder reported his work was highly regarded, and perhaps unusually, well paid for.

We saw the other day, at the residence of the artist in Lower-Grosvenor place, a model by Mr T D Dighton, of a mansion …

Mr Dighton’s models are well known to the profession, and have given him a reputation which will be further increased by the work to which we are alluding. The demand for architectural models of a high character, requiring patient devotion of time, knowledge of architectural details, and great mechanical skill, is so small as to offer little inducement in a pecuniary point of view to men fitted to produce them. In this age of casting, electrotyping, and otherwise reproducing, a hundred pounds, which would perhaps, little more than pay for the time and talent spent on the model before us, would seem a large sum, and willingly be paid by a very few.

The same volume noted the contrasting situation of Richard Day.

There are few architects who are not acquainted with the admirable models made by Mr Day. We are sorry to hear, that after struggling for some years to make a living by the practice of his art, he finds his efforts fruitless, and that he must either seek some other occupation or starve. It seems sad as well as surprising, that with the ability he has acquired in this particular path he should not be enabled to maintain himself by the exercise of it. Some of our readers may, perhaps, be disposed to aid him.

The moment described here passed off without disaster; Day appeared in trade directories between 1838 and 1860, also exhibited at the Great Exhibition and featured in the Mapping Sculpture website as an architectural modeller.

3.4 Craft or Art?

Attitudes to Art

In the histories of those makers identified so far, the differences in how they were treated (technicians, students, assistants, artists, businessmen in their own right) highlighted societal distinctions between art and craft. Attitudes to art as well as to

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242 Anon., 1851, p. 829, entry 142 St John’s Church Paddington; p. 835, entry 235A Preston Hall; p. 830, entry 160, Part of the Record Office.
244 The Builder, 1848, VI, p. 225.
245 The Builder, 1848, VI, p. 490.
246 Five entries, as a ‘modeller’ - two porticos, a church, a chancel and a church window and the Martyrs’ Memorial in Oxford.
craftsmen and artists changed over time. The meaning of ‘art’ varies both culturally and historically; in his cultural history of art, Larry Shiner (2001), Professor of philosophy, argued fine art is a modern invention, the art/craft distinction emerging from European social transformations in the long 18th century. His interest arose on finding it was problematic to refer to African figures and masks as ‘art’, ignoring their original ritual function, when they were moved from an ethnographic museum to an art gallery (Shiner, 2001:xv). Attitudes were institutional; the institutions involved were central to constituting things as art (determining what should or should not count, or be remembered); African items were art in an older sense, of things made for a purpose. I return later to the question of defining the canon (thesis:235).

Shiner identified three main divisions; splitting the sense of ‘art’ meaning skill, into ‘fine arts’ and ‘crafts and popular arts’; distinguishing artists and artisans (interchangeable terms until the 18th century, opposites by its end); and separating aesthetic concerns from utility and ordinary pleasures (Ibid.:5). ‘Nobler’ aspects of the pre-18th century artist/artisan such as grace, invention and imagination were ascribed only to the artist; the artisan was said to possess only skill, to work by rule and to care primarily for money (ibid.:13). Describing the interplay of intellectual, institutional and social economic factors in the emerging new fine art system, Shiner noted the breakdown of the patronage system, the rise of an art market, and the expansion of a middle-class public for art. A new image of artist as creative genius took hold, along with a new concept of the ‘work’ as a self-contained world (ibid.:77). Institutionally, this was encouraged by the founding of academies; the painter’s identity began to receive more prominence in catalogue descriptions than the subject matter, with growing emphasis on originality and expression (ibid.:103).

Commissioners of models intended them for use. Crystal models assisted with scientific visualization, also unusually being handled by the viewer, whether teacher or student. Architectural models were shown to publics in controlled exhibitions by institutions – the Cathedral, the Royal Academy. Dioramas were installed in grand museum buildings where raucous behaviours would be repressed, so appreciation of the scenes shown was encouraged at an aesthetic level none-the-less, as well as by schoolchildren in organized classes. Shiner discussed the history of the development ‘from taste to the aesthetic’(ibid.:135), quoting how the Louvre Palace, Paris, opened to the public during the French Revolution, posted notices asking visitors not to sing, joke or play games. The models’ audiences would have been expected to behave decorously, to better appreciate the intended explanation or instruction. More sophisticated members of the
emerging art public were ready to treat painting and sculpture as the object of refined or spiritual pleasure.

The first Director of the Louvre, Jean Baptiste Le Brun, was himself a painter (and married to one) but he was also a dealer, and having inspected thousands of pictures claimed justified expertise about value through attribution and authentication. His credibility was established by appeal to gentlemanly culture, not least via auctions, a vital source for collectors. Le Brun made a virtue out of correctly assigning authorship to paintings (with a reference collection of signatures which he copied and retained for many years), taking pride in his expertise even if a painting’s value was reduced as a result. It was possible to rise above the low esteem in which auctioneers were held by appealing to refined consumption. James Christie, founder of the eponymous London auctioneers, used a Chippendale lectern, and turned important auctions into invitation-only prestige events. Catalogues compiled by experts enhanced the value of provenance and became useful reference works for connoisseurship.

The early 19th century idea of art as creation called for contemplation and separation from context. This new system was linked to behaviours, institutions and more general relations of power and gender, but was not uncontested. Shiner explored examples of both resistances and assimilations, noting Hogarth, Rousseau and Wollstonecraft rejecting the split between artist/artisan and aesthetic/instrumental, and later, Emerson, Ruskin and Morris, the art/craft and art/life dichotomies. For the collections under study, crystal model makers were largely seen as artisanal; architectural model makers were in ambiguous positions straddling art and artisanship; and diorama makers, trained artists, were none-the-less commercial, producing results to order and to price, for 20th century institutional patrons. All used manual skills to produce representational models. So the makers’ output would be seen as ‘Crafts and popular arts’; makers would not be regarded as free-spirited artists in the later 19th century, with a slight exception for diorama-makers. I would suggest for today’s audiences, the models all have aesthetic aspects to them, being capable of exerting ANT-style force. Shiner (2001:9) saw the boundaries of ‘fine art’ expanding to include new forms of art (photography, film) including everything and anything; exploring historical roots was a worthwhile prelude to rethinking existing ideals and institutions. A single crystal model would not be seen as a work of art, but assemblies sympathetically displayed (by other people than their makers) make a huge impact on audiences. Where institutions demonstrate that they

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249 S Werrett, Knowledge or Nick-Nack? Auctions and Experimental Science in 18th century Britain, same workshop.
value the models, audiences are invited to feel the same way; the reverse is occasionally true too.

Identification of an authorial hand remained debatable, Roussel being unusually acknowledged as an originator/pioneer of the diorama form (and as an artist) but also working collaboratively (thesis:108). Sculpture, 3D art, was collaborative and hierarchical, even with respected named artists in the lead. Adamson (2013:155-7), discussing copy-making for the Ruskin-approved reason of widening knowledge of sculpture originals, noted some sculptors were authorial geniuses, others worked ‘mechanically’. A quick sketch led to a small scale maquette or a full-scale model in clay. The autograph work was used to make a cast, then remade again or, in marble, using a pointing machine. The piece would be carved roughly by assistants and finished by the sculptor.

The role of sculpture as public art was the focus of the Tate Britain exhibition *Sculpture Victorious* (2015), which attracted mixed reviews; whilst not including every famous Victorian sculptor, it emphasised how collaborative sculpture-making was. The exhibition featured representations of Victoria throughout her lifetime and throughout the British Empire, sculpture in ceremonial, commemoration and national history, how it was displayed, the influence of new techniques of (mass) reproduction and the growing interest and market of middle and working class people. Public engagement included subscription, newspaper reports and illustration, photography and mass events such as unveilings and funerals; the appetite for consumption led to a demand for copies in cheaper materials, smaller sizes and other representational methods than the originals. New techniques made many more reproductions available to mass markets. The massive catalogue gave in-depth discussion of each exhibit, naming the people involved in its creation, with selected bibliography and noting where it had previously been displayed (Droth et al, 2014).

**Attitude to craft**

Where makers were seen as craftsmen, knowledge of their identities was easily and rapidly lost by their contemporaries, and hard to retrieve. Medieval master masons could leave their mark; architects of the same period, many of whom were master masons themselves, occupied an anomalous position, working with their hands but, when successful, being acknowledged by name (Lucie-Smith, 1981:130). But similar influences to those acting on painting helped transform the image and status of the architect, resulting from the surge in urban construction and middle-class wealth, and the growth of professional organisations such as the Society of Civil Engineers and the
Institute of British Architects (Shiner, 2001:103-104). Greenhalgh (1997:25), writing on craft history, noted a lament in the *Builder’s Magazine* of 1774 that architecture was not considered a fine art. However, with increasing industrialisation in the 19th century, application of standardising machinery to production, reproducing things more cheaply and quickly than by handcraft methods, craft skills declined even as the number of trades (no longer under the firm control of guilds) expanded enormously (Lucie-Smith, 1981:199).

Despite its role celebrating ‘manufactures and works of industry’, the 1851 Great Exhibition did not thrill everyone. One critic was John Ruskin, who began to write the second volume of *The Stones of Venice* on the opening day of the exhibition – Effie, his wife, had a season ticket (Jackson, 2011:64). Ruskin idealised hand work over industrial production, remarking:

Wherever the workman is utterly enslaved, the parts of the building must of course be absolutely like each other; for the perfection of his execution can only be reached by exercising him in doing one thing, and giving him nothing else to do. The degree in which the workman is degraded may be thus known at a glance, by observing whether the several parts of the building are similar or not; … if, as in Gothic work, there is perpetual change both in design and execution, the workman must have been altogether set free (Ruskin, 2009:151).

William Morris also thought crafts were undermined by industrial production and fine art practice, and prevented from serious aesthetic and social consideration (Greenhalgh, 1989:19-21). His reaction was to attempt to rebuild crafts based on a Romantic vision and social reform ideas, influencing the Arts and Crafts Movement from the 1880s. Morris designed furniture and interiors, mastering appropriate techniques and materials and going into commercial production in 1861. Nonetheless, as Greenhalgh remarked, up to 1914, most objects produced in Britain were still hand-made in part; Morris himself knew little about factory life or mass production.

Attention to the nature and history of craft skills was sharpened by David Pye’s study of workmanship (1968) (thesis:35). Pye trained as an architect, specialising in wooden buildings. After World War II, he taught in the Royal College of Art school of furniture design, becoming professor in 1963 (Dormer, 1991:144). He drew a distinction between design and workmanship, the latter being the application of technique to making, through care, dexterity and judgement on the part of the maker. He also distinguished between workmanship of certainty, involving predetermined results for every operation during production which could not be altered once production started, and workmanship of risk, where each step depended on direct attention by the workman. Tools, jigs and prototype machine tools created through workmanship of risk resulted in workmanship
of certainty (Pye, op. cit.:22-25). Adamson (2007:72) regarded Pye's book as ‘the most compelling technical discussion of skilled work ever written’, noting that in 1982 Christopher Frayling and Helen Snowdon commented that Pye separated manual skill from mental skill against the grain of Arts and Crafts Movement opinion, scorning Ruskin’s moralising on craft.

Through the 1980s and 1990s, academic attention to craft, design and the art of the maker grew apace; the V&A produced a Crafts reading list with 25 titles under ‘General’, dating from 1968 to 2002 (‘Crafts’, 2016); more recently, Adamson’s work stands out as craft practitioners continue to grapple with their history and their relationship with the fine arts (2007; 2013). Harrod (1997) reviewed the crafts of the 20th century, under the aegis of the Crafts Council, formed in 1971 as the Crafts Advisory Committee. This advised the government ‘on the needs of the artist craftsman [sic] and to promote a nation-wide interest and improvement in their products’ (‘Crafts Council’, 2015). In contrast, the Arts Council’s precursor was formed in 1946, to help promote and maintain British culture, with government funding (‘Arts Council’, n.d.).

In the late 1990s, the studio craftsperson was seen to be largely unlikely to earn a living solely through craft. Dormer (1991:153) suggested despite craft being the most important part of their lives, further support was required from spouses, or other work such as teaching. The few making a full-time living showcased their work through networks of dealers and galleries. The ceramicist Carol McNicoll, contributing to Harrod, wrote from her own experience that life as a craftsperson was economically unviable; she had trained as a fine artist in the 1960s expecting to claim benefit and make works. Transferring to ceramics offered a potential living, but ‘for endless new ideas you need time; to have time you need money; to make money, you need either to charge art prices, run a factory, or have private income’ (1997:379-382). She taught part-time, observing that for most fine artists or craftspeople, their work is a hobby.

Comparing these scenarios with the model makers in this thesis, a controlling patron was required for modelling to be a full-time job. University technicians made models for their scientist employers; educated businessmen diverted some of their income to having models made. The architectural models at the Cathedral were made by junior or low-status members of staff; the artist/craftsman dichotomy was not seen as significant, drawing skill was assumed. The diorama makers were almost always referred to, and thought of themselves, as artists, but undertaking alternative work if funds were low. Some taught; many were commercial artists of one form or another, with posters, book jacket and other illustrative work being the most common. The dioramas were not
produced as free-standing art, although that could become a criterion for retention or disposal once removed from exhibition.

**Attitudes to copies**

Institutional attitudes to collections and copies also vary, over time and from place to place; my study includes copied crystal models, made from casts for/by Griffin in 1840 and from iron models in 1912 by NMS technicians. A useful example to explore the craft/art distinction related to copies is seen in the varied history of plaster cast making. As a sculptural material, plaster has been used since antiquity, not only for stages in production in other arguably more durable materials, but also as copies for transferring images from one place to another, and as artworks in their own right. My own introduction came from the Watt workshop; the two largest items in the room were sculpture-copying machines designed by James Watt (Snr). The room also contained over 20 plaster cast moulds of impeccable provenance, numerous packets of experimental mixtures and a large collection of test pieces generated on the machines (Insley, 2013). Until the 1960s, artists trained by drawing copies (thesis:152), frequently plaster cast copies of other original pieces.

Recent work brought together by Frederiksen and Marchand (2010) created new narratives for surviving cast collections. Scholars, curators, conservators, artists and a collector, from twelve countries across Europe and the Americas, investigated complex underlying narratives for surviving examples and historic cast collections in 2007 at Oxford, UK. Copy casts were hugely popular in the second half of the 19th century, but became regarded as inferior to originals by the early years of the 20th, a point to which I return in a later section discussing institutions’ attitudes to their own histories (thesis:184). Many collections were discarded, but some are redisplayed and promoted, notably in the Cast Courts of London’s V&A Museum (Lesic, 2012). An important source for the V&A collections was the stock from the sculpture copying business of Domenico Brucchianni (1815-1880), featured in my trade literature research as one of the longest lived architectural modelling businesses (thesis:144), and for which the story is worth considering in more detail.

Brucchianni, a well-respected teacher of modelling, appeared as model maker in trade directories, and led a company manufacturing plaster casts to service major museums (for display) and increasingly their visitors (for retail). According to *Mapping Sculpture* (2011), he taught modelling at the RCA from 1853 to 1861, being listed as a Professor of Modelling in Clay in the 1851 Census, and in POLDs for 1851, 1860, 1890 and 1900; my study extended this to 1920. More details were described in Bilbey and Trusted
(2010), a contribution to a major review of plaster casts world-wide. Brucciani’s business was one of the main London cast makers through the second half of the 19th century, supplying the British Museum, Government Art Schools, and the South Kensington Museum. After his death in 1880, the business continued from the British Museum but by 1909 was no longer financially viable. Taken over by the Board of Education in 1919, between then and 1921 the stock and moulds were transferred to the V&A as a museum service supplying casts coordinated with art school syllabuses. It ran at a loss for many years, with aging moulds producing increasingly inferior copies. Post-war revival was limited, and the service closed in 1951, despite complaints from the Museums Advisory Council that this damaged the educational work of the museum. There is a resurgence of interest in plaster casts through the V&A redisplay of its Cast Courts (thesis:22,178, 214, 229).

Copy casts were used both as stages in sculpture production, and with fluctuating popularity in collections and museums. Arguably, the moment of peak importance for copied artworks came in 1867, when Henry Cole, in his role as first Director of the South Kensington Museum, instigated an international treaty with the princes of Europe to share works for copying. This embodied the museum’s founding mission, to educate practitioners, and enlighten the public (Patterson and Trusted, 2018:17-18). Similar practices took place in America; Wallach (1998:38-46) charted the use of plaster casts in US art museums, which between 1874 and 1914 acquired thousands of replicas of classic sculpture, introducing a canon of casts – named examples from the antique and the Renaissance. Samuel Parish, collector/founder of the Southampton Art gallery (Long Island, NY) in 1898 had declared that plaster reproductions of ‘those masterpieces of the genius of man at its highest period of development in the world of art’ outweighed modern pictures in educational worth. Wallach considered the development of collections at the Corcoran, Boston Museum of Fine Art, Slater Memorial Museum and the Metropolitan Museum as competing with European museums, offering the civilising influence of the classics, to all, through copies (ibid.:47).

Challenge came from the growing enthusiasm for originals, increasingly affordable to wealthy collectors in the 1880s and 1890s, advised by increasingly professionalised dealers and experts. To widen audiences and display their taste, collectors patronised cultural institutions, accommodating their requirements with changing policies. From 1904 the Metropolitan aimed to show only originals, abolishing its post of Curator of Casts in 1906; by 1936 no casts were displayed. High aesthetic standards preferred originals in bronze or marble to plaster copies (ibid.:51-52); Boston’s Museum of Fine Art declared in 1910 ‘the final perfection of style in the work of the great masters cannot
be reproduced in plaster’. The 1920s became a period of disposals known as the ‘battle of the casts’, remarked Simon Jenkins (2018), reviewing the decision of European Museums to return looted treasures from their collections. The early 21st century British national directors’ report *Too Much Stuff* (discussed in the next section of this thesis) even cited plaster cast destruction in art schools and museums in the mid-20th century, a contributing factor potentially to recent interest in surviving examples (Fredericksen and Marchand, 2010).

Ideas of originality, authenticity and genius were still contested (from Walter Benjamin onwards) (thesis:32) even in institutions where artistic independence might be at odds with the market. John Haber [2009], considering *How Museums Grow* on his website on post modernism and art history, disagreed with Wallach’s comparison of shift from casts to originals with the shift to display modern pictures – ‘if modern artists learned by drawing from casts of great sculpture, they were producing mere copies of copies. They could not make great art, because that would take an original’. But for Haber, what changed was new means of reproduction – copies were less essential because their function in art education was taken by slide lectures and illustrated textbooks as well as the originals. Haber completed his piece by critiquing the valedictory exhibition for out-going director Phillippe de Montebello, its history of art and the history of its exhibitions. Jenkins (2018), in the same article mentioned above, described the new V&A Cast Courts, due to reopen fully the following week, as the most exhilarating room in any London museum – everything in it is fake, he declared, and a hugely enjoyable satire on what modern museology has become. But he did not explain why the V&A had chosen this moment to pour effort into reconstituting this display.

Two on-line blogs give suggestions. Brendan Cormier (2017) pointed out that some of the casts have either out-survived the originals, or are in much better condition, having been indoors and protected during their active lives. Becky Knott (2017) described the advance of 3D imaging on the one hand (expensive for museums in terms of equipment, computer power and memory) and on the other, composition of 3D images from many 2D images taken by enthusiastic visitors, which the V&A discovered was already happening to items on display, and which they chose to encourage.

**Institutional attitudes to models (Is it real, and does it matter?)**

More detail of institutional attitudes to the use of models in my case study institution, the Science Museum, is shown by considering evidence for its use of models in general, how they substituted for other things, and whether this mattered. When dioramas were first installed, the main galleries showed machinery, ship models and science collections
(Phillips, [1934]), with other displays covering development of different types of machines and working principles. The museum offered descriptive collection catalogues and historical handbooks, guided tours and special lectures. ‘Visitors needing a general view of the exhibits’ were recommended to visit the galleries in number order, following the Guidebook (ibid.:5). The authoritarian, one-way transmission of information gave little concession to non-experts. Of six photographs of items on display, two showed models, one of the original Wright aeroplane, and the other of an Elizabethan galleon.

The Guide to the Children’s Gallery, published in 1936, spoke more directly to its readers, and used history to link permanent exhibits. The lead curator, F. St A. Hartley (1936:3), stated ‘the Gallery’s chief purpose was to show what things mean, that is, their significance in our daily lives, rather than how they work’. That they needed to say this suggests that it was not a familiar take on the displays, and, ironically, is rather the reverse of the effect ANT ascribes to non-humans. Manipulating working demonstrations explicitly demonstrated how they worked; showing significance was more complicated. Encouragement to consult the Attendants was more friendly in tone, with a final suggestion to ‘not think of the exhibits as things to play with, but try to understand and learn from them’, the accompanying explanations and Cawood’s illustrations. Expanded editions came out in 1953 (reprinted in 1961) and in 1963, both repeating that the gallery served as introduction to the main collections. New inserts to the text represented display items before being shown in other galleries; the premise of the gallery-as-introduction was robust. Post-war guides no longer carried advertisements in the back for educational toys and model making.250

Outline Guides to the whole museum were produced up to 1959. The indirect form of wording used from the 3rd edition onwards loosened slowly; the museum made extensive use of models, representing items too large or unavailable for display. There were working demonstrations (some requiring an attendant) and sectioned working replicas; the word ‘model’ ambiguously indicated either the item was not the real thing, or it was an example of a particular kind of machinery or apparatus. Scale – whether the displayed item was full-size – was not always mentioned. Where models were created by the inventor in the process of discovery or invention, this was stated; where originality was important, this too was emphasised. However, the 1953 edition failed to explain that Dalton’s Lecture Diagrams were copies, despite background information that they had been made in advance of wartime destruction of the originals – the importance of what they represented outweighed their inauthenticity (Anon., 1953:28).

250 Bunney (2010) discusses this further.
No particular distinction was made between replica and copy, as for example, ‘a replica of the first practicable typewriter’ (Anon., 1953/1959:14).

The format changed in 1965 to a selection of Fifty Things to See, of which six were models, one, item 18, being a diorama – Marble Arch by Night, from the Children’s Gallery (Plate 28). The author, John van Riemsdijk, spoke highly of its artistic quality; it was ‘one of the oldest, but also one of the finest, in the museum. It is by Raph. Roussel, an artist whose work, in this and other museums, has shown that the diorama can invite comparison with formal painting’ (1965/1976). As a curator and civil engineer, van Riemsdijk appreciated the model-making talents of museum staff – item 11, a model of the Deptford Power Station, was ‘one of the most recent of the many fine models produced in the museum workshops over the last hundred years’.

Part of the Science Museum’s contribution to the 1951 Festival of Britain was a special exhibition, The Science Museum: Past and Future, for which Dr Frank Greenaway compiled a short museum history (1951). Greenaway noted even in 1837 the Government School of Design had accumulated a collection of busts, casts and other art objects for instructional purposes, and plans for the Department of Science and Art included ‘museums by which all classes might be induced to investigate those common principles of taste which may be traced in the works of excellence of all ages’ (ibid.:3), so arts and crafts were privileged. Science Collections, as they developed, were aimed at artisans and their teachers; the Educational Collection contained books and models supplied by manufacturers of educational equipment. Price lists were included in museum catalogues (ibid.:4). In a short centenary volume produced in 1957, Greenaway noted another important model collection, formed by Bennett Woodcroft, Director of the Patent Office (1957:3). He acquired models submitted to the Commissioners of Patents to accompany paper designs and also items of historical importance, including the Rocket and Puffing Billy locomotives, Arkwright’s spinning machinery, and Wheatstone’s electric telegraph apparatus.

As Science Museum exhibits, then, models could be as significant as the ‘real’ thing, performing the same tasks for educating audiences. Differences between various forms of unreality were not explained to audiences, and unless the model was associated strongly with the inventor, it was unlikely the maker would be acknowledged by name. Roussel (the only artist in the book) being so acknowledged in Fifty Things to See was indeed unusual.
1. Diorama, *Marble Arch by Night*, displayed [ScM image]

2. Diorama, *Marble Arch by Night*, stored
Invisibility?

For artisan makers, skilled manual workers, full-time employment in major educational establishments offered security, but accompanied by anonymity. Technicians even today can drift through university departments almost un-remarked. Sociological research into laboratory work has begun to address this (Latour & Woolgar, 1986); one example is an oral history of laboratory technicians at the Medical Research Council’s National Institute for Medical Research in north London, (Tansey, 2008), published by the Royal Society (arguably the UK’s premier scientific body). A similar situation obtains for architectural model makers employed by architects – their professional existence is submerged under the name of their patron. Where they strike out on their own, they can become more visible, from such possibilities as not-quite-impartial gathering of information for trade directories, or if their work enters a public institution. The diorama artists became most publicly visible through enthusiastic reporting in The Times, and evident popularity of the models with visitors. The Imperial Institute was followed rapidly by both the Science Museum and the Museum of Practical Geology introducing dioramas as part of the public offer. However, whilst Roussel was clear about recognition for his skills and status as an artist, neither he nor the other diorama makers wrote about their work, leaving it to a cross-over personality like Gordon Whatman to describe it in a Studio magazine article.

Invisibility of details behind a diorama’s conception could occur directly from the methods of raising money to pay for it. In the Imperial Institute, individual displays or ‘courts’ were funded by the countries represented, usually through their High Commissions. Within the Science Museum, where sponsors were frequently trade associations, the artist might be paid by the association rather than the museum; the diorama was recorded within the museum as being given by the association, which retained all the background paperwork. The museum lost direct memory of how the diorama came to be made, and lacked archival material to resurrect it. Payment this way was noted in files concerning the exhibition of which the diorama was a part; further information became difficult to find.

Some diorama artists produced a prodigious amount of other art. If this took much of their time, that they rarely wrote about it could be seen as reasonable – these people communicated through drawing rather than writing about a small part of their working lives. As the dioramas themselves are withdrawn from public view, recollection of both dioramas and makers disappears.
Summary

My directory search uncovered 186 makers with dates and London addresses, who self-described as architectural model makers between 1799 and 1991. Bearing ANT thinking in mind, those NOT mentioned were employees, students, or assistants, and only a handful were named as connected with the Cathedral – Thorp for restoration, Farmer and Brindley for other types of work, and Wilby as a hobby modeller (a category also represented in Cathedral holdings, but not my main focus). General surveys of education and training for people who would be manual workers was gleaned from general histories of education; some literacy, numeracy and ability to draw would all be useful or desirable. A surprise discovery was how widespread manual skills must have been, and the importance of self-help through printed works (ANT immutable mobiles), societies and journals, as guild-based training methods became less relevant. Training of architects either through pupillage or up-skilling included some discussion of the value of models in practice. Diorama artists were not only more or less formally trained as such, several went on to lead workshops or be teachers themselves.

I deduce how they were seen from indirect evidence – the makers were versatile, but status-conscious; Roussel’s contracts were efficient in this way, Farmer and Brindley’s practices more ambivalent. Acknowledgement of assistants depended on the scale or nature of their contribution – Carangeot was intellectually active; Beloeuf lived on site. One indicator of success was business duration, which for some businesses was several generations. Within wider society, attitudes to model making should be seen alongside changing attitudes to art, with a notable division growing between fine and popular art, artists and artisans, and whether created objects should have utility. The models I study did have utility, representing idealised but real originals to specifically chosen audiences, to help understand the action or function of the original. Their value in ANT is the success with which they do this, which I attribute to their makers' skill in making types of copy. Directing focus to an (absent) original reinforces the idea that a model is somehow less important; but the model has its own materiality and identity, similar but different. Understanding and being open about the difference is part of the radical transparency that careful custodianship currently demands.
4 Towards Invisibility

4.1 How institutions forget

Introduction

I begin this section by considering how the three institutions (St Paul’s Cathedral and the Science Museum, London, and National Museums Scotland) ‘work their past’, a term used by Charlotte Linde (2009) describing how institutions project their own histories in their official narratives (what they regard as significant). Linde also used the phrase ‘noisy silences’ to indicate the absence of information one expected to find, such as (here) identities of model makers. My subject collections are all regarded as secondary to their institution’s main functions; neither they nor their histories are in the forefront of what the institutions do. As Latour envisaged ANT, focus would be on action rather than meaning, so the previous sentence highlights the loss of day-to-day significance these models have for their owner institutions. Applying ANT to the research question for this section (What factors affect processes of remembering and forgetting?), I concentrate primarily on those mechanisms in the network operating on the commissioner/client – management committees controlling policy, funds and access, potentially influenced by external opinion (even if not internally expressed) – and the visible actions of human actors mediating between completed model and intended audiences.

Then I consider disposals. What is chosen to be remembered is determined through policies and practices of acquisition and disposal. What is acquired involves selection, dismissal and therefore official forgetting of the unselected; all three institutions have a presumption of retention of items once acquired. However, disposals from collections have always happened, in a variety of ways, sometimes contested, whilst being another obvious method of official forgetting.

First, commonalities. For all three, the public are welcome to enter free of charge for the main purpose of the institution – access to core collection displays for museums, or to services as worshippers, for the Cathedral. Visitors with particular interests can meet relevant members of staff behind the scenes, for which there is also likely to be no charge. All charge for admission for either non-related access (tourists to St Paul’s), or special events or exhibitions (museums). ANT enactments covering a visit would involve considering visitors, buildings, staff (religious, secular, front of house and behind the scenes), and collections – the things they come to see. The institutions control access, physically (opening times), economically (charges), and through staff-visitor contact.
Where first contact is via websites, virtual visitors will find a brief mention of the institution's history somewhere relatively accessible from the home page, usually a timeline giving dates, events and images illustrating the past, but not in any depth. Websites also access public parts of institutional databases, such as library holdings (museums) and objects in the collections including archives (museums and Cathedral). Access is not fully open, regulations and practices determining what can and cannot be seen varying between the institutions. All come under Data Protection law; the museums as public bodies also come under Freedom of Information Acts. Recent individual papers may be unavailable. There is a 50 year time limit for the Cathedral generally, though sometimes the information is published elsewhere; museums abide by National Archives practice, currently being reduced from thirty to twenty years. Papers may be redacted for other reasons, which may or may not be overt. The extent of access to collection information is a rich source of invisibilities. Here, ANT suggests scrutiny of websites as portals to institutional access to their holdings, and sources for contextual control mechanisms. Virtual visitors only become actors once logged on, their likely requirements being anticipated by invisible website designers.

For physical access, all three institutions offer guided tours of various sorts within which its history may be mentioned. Cathedral volunteer guides offer programmes varying from a standard half hour tour of the main floor with indications of what is in other parts of the building, to longer more specialised tours based on particular subject areas. Museum tours are generally organised around exhibitions, through front-of-house, collection or education departments. The Cathedral has both secular educational teams and a more formal study foundation. More specialist tours led by permanent collections staff can be arranged for special events such as Open House weekends or commemorations; lively outreach programmes are essential. There is inevitable selection of what is told, and by implication what is not. Investigating tours as ANT enactments would consider institution, tour, guides, items included in the tour, information divulged during the tour, and visitors receiving the information.

Another way institution history is offered is through publications and souvenirs. The Cathedral, with a far longer history than the museums, has numerous publications about its past. Museums may have guidebooks, exhibition and collection catalogues (historical introductions giving tantalising glimpses), and historical publications produced at anniversaries or mergers. Occasionally, individual members of staff study their institution's history, but publication is haphazard, fragmentary and variable. ANT invites consideration of how audiences access the publications, through shops, on-line ordering, and physically-present visitors; publications become immutable mobiles.
How St Paul’s Cathedral ‘works its past’

Cathedral practices stem from 2000 years of Christian belief. The present building is over 300 years old, housing physical memorials for the City of London and the nation; it hosts ceremonies of praise and remembrance for various reasons and various scales. Seeking history via the homepage, visitors to the website (‘St Paul’s’, 2019) find its branded logo, daily timetables for events (both services and sightseeing) and options to explore further information about worship, music, visiting in person, opportunities for scholastic learning and faith, its history and collections, how to offer support, and more commercial aspects. The top toolbar offers information about contacting the Cathedral, arranging permission for filming, photography and other communications, job vacancies, the souvenir shop, service schedule, news and videos (of services, discussions, talks, etc.). As a source of invisibilities, the website self-evidently excludes those without electronic access, which may affect on-line events bookings; it is in English, less of a barrier than it might be, with web-based automatic translations.

Physical access to parts of the Cathedral is free of charge at specified times; other parts require an entrance fee and (even) fitness. Historical information is included in talks by visitor guides both sides of the tills; additionally, there are electronic audio sets describing highlights of various kinds for people to explore at their own pace, in nine languages. The crypt is renowned for graves and memorials for military and political heroes, famous artists and some Cathedral staff, including Wren. The church floor is an imposing cruciform space, with important art works and other memorials, and a significant decorative scheme for the higher surfaces and ceilings.

A free introduction lasts 20 minutes; longer tours last up to an hour and a half, guides choosing selected items, tailoring content to visitor interest and prior knowledge. Guides train in crowd control, health and safety, and considerable detail of Cathedral and contents over several months, background information being extended by personal research. Detail in any tour is necessarily limited; for specialists there are other offers by members of the Cathedral staff. The Library and Trophy Room are in parts of the building with restricted access, Archives and Conservation even more so; stored material is brought out on occasions, and explained by specialist staff or researchers. The Education department addresses faith in the widest sense for formal school visits.

Of numerous books about the Cathedral, several were written by official staff: notably, Rev W Sparrow Simpson, Cathedral Librarian from 1862 to 1897, and W H Hale, Archdeacon of London 1842 to 1870, both sorted archives and compiled finding aids.
More recent works by academic historians demonstrate widespread and enduring public interest in this iconic building (Saunders (2001); Keene (2004); Campbell (2007)).

It is possible to become extremely well-informed about some aspects of the Cathedral and its history whilst remaining ignorant about others. Sources are extensive, both in and outside the Cathedral’s holdings. The Cathedral Library focuses on religious and literary texts; the Architectural Archive holds material related to the building fabric, and the object collections include vestments, silverware, models and scientific instruments related to building repairs and its continued use, with information available through the public database.

Externally, large tranches of archive material were transferred firstly to the Guildhall Library, then in 1980 to London Metropolitan Archives (LMA); complete cataloguing is still unfinished; the LMA listing of material related to Cathedral and its Dean and Chapter (the administrative unit that runs the Cathedral) cites about 6000 ‘production units’, with 21 references to introductory publications listing archive material. The most notable gap is of papers stored in the Chapter House, destroyed during World War II. The magisterial historical survey by Keene et al (2004) gives an overview enabling further explorations.

The resources are so extensive it is a surprise when you come up against boundaries. The Cathedral database is not all publicly accessible; restrictions on access include date limits on some material (younger than 50 years, for Dean and Chapter minutes); records earlier than a date in the 19th century are stored at LMA. Material is subject to Data Protection Acts and, to a degree, to the Freedom of Information Act; items of interest may be redacted. Within the Cathedral, physical access to some storage is awkward or complicated (narrow passageways, spiral staircases, through spaces occupied by other departments); public access is impossible. At LMA, incomplete cataloguing may mean some information although present is hugely difficult to find; searches may be tortuous and long-winded.

The over-arching policy determining approach to collections care is a document called the Cathedral Measure. This document, the latest version passed in 2011 by the General Synod of the Church of England, is analogous to the National Heritage Act for museums, outlining the duty of care the Cathedral should show to the items it owns; with limited resources and tens of thousands of artefacts and documents, this is challenging. A Collection Care section within the Cathedral (covering library, archives,

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251 LMA Reference code CLC/313 Collection St Paul’s Cathedral: Dean and Chapter.
vestments, memorials, regimental banners and various artworks and silverware) has been in place since the 1990s, following museum practice, whilst not being the Cathedral’s primary function. The collections can be studied by volunteer teams, interns, visiting researchers and consultants, supervised by a very small staff; the aspiration is that the collections database will become its definitive tool for future work. That the Cathedral could not say how many models it has is less of a surprise than the equivalent situation in a museum.

For the architectural models, an added complication is that many were made by people not directly employed by the Cathedral, so it would be illogical to expect much provenance information except with assistance from internal staff. The post of Surveyor to the Fabric is not full-time; assistants are not Cathedral employees. Nonetheless, there have been occasions where the attitude of church people to secular support staff has bordered on the churlish, from the days of Wren himself. Telling newly-found stories helps redress resulting invisibilities.

Celebrating models in Cathedral history happens most visibly in the Trophy Room. From the beginning, the Great Model made for Wren by the Cleere’s was used to inform clients and as a money-generating visitor attraction. The histories of the individual architectural models in the collection show that displaying models to wider publics is problematic; Burges’s models were shown to the Dean and Chapter in the Chapter House, then more publicly at the Royal Academy’s Summer Exhibition. The history of the Great Model shows it has been frequently moved around the Cathedral’s spaces, each time putting the model at risk (Rome Innes, 2002). Regular requests for its display elsewhere are considered individually.

How the Science Museum ‘works its past’

The Science Museum has its origins in the Great Exhibition (1851), first of the International Fairs staged through the rest of the 19th century and into the 20th. Intended as a glorious global trade show in the Crystal Palace, Hyde Park, the organisers used the profit to acquire land near the original site, for the South Kensington Museum. This was divided in 1909 into the Victoria and Albert Museum (fine and decorative art), and the Science Museum (physical sciences and engineering) (‘Science Museum’, n.d.).

Having its beginnings in a determined effort to show off the most modern, the Science Museum has continued presenting the innovative and the new. Acquisitions showing steps in technical development grew into historical collections, with on-going challenges for exhibition and preservation of historical material, not least because of strong
nationalistic pride in Britain’s role in the growth of industrialisation. One feature of the long and painful history of moving collections from unsuitable iron buildings to a purpose-designed stone one was that the question of reducing or dispersing them was regularly rebuffed (Sheppard, 1975: 248-256).

With a building and collections but little money, exhibits were displayed in chronological order (a display method reflecting attitudes to progress while giving a sense of date), with very technical labels challenging the visitor’s own interest. The Introductory Gallery of 1931 aimed to increase the museum’s attractiveness, not least to children. Environmental conditions including lighting were controlled; the story of transport through the ages was displayed in a series of dioramas created by the team led by the man who originated the concept, hands-on demonstrations of machine principles that visitors worked themselves, and ‘real’ objects and artefacts for comparison. Dioramas gave the collections context, through scenes set at particular dates. They were internally lit, bright compared with the rest of the gallery and very appealing.

For visitors, what is shown openly of the museum’s own history would be by awareness of building style, and realising that identifying numbers on labels sometimes give acquisition dates. Within galleries, subject histories were more important, specialist curators working to make catalogues and gallery guides authoritative. The first description of the history of the museum itself came in 1951, in an 18 page pamphlet compiled by Frank Greenaway, then chemistry curator (thesis:181). A short historical sketch ([Greenaway],1957) contained a seven page account of the museum’s history, with a longer section describing twenty one of the more important historic exhibits and stories of the men [sic] behind them. In the preface, T C S Morrison-Scott, Director, credited his predecessor Dr F Sherwood Taylor for suggesting the volume, remarking that the articles had been contributed by ‘members of the staff, and the photographs were made in the museum’s studio’. Neither these lesser characters nor Greenaway was named.

The museum’s focus was the acquisition, preservation and display of artefacts, the inventory system assigning each a number (year-hyphen-ordinal number of acquisition). That number acted as identifier for related documents, images and references, most importantly for collections management being location. As collections grew, maintenance of house-keeping records required a growing specialist staff; curators chose new acquisitions, and researched those already preserved. Once an object was accepted into the national inventory (full ownership passed to the museum), the premise was that it should be retained in perpetuity.
Although the museum tacitly accepted it could not be fully comprehensive in its collecting, there was intrinsic selection already. The Bell Report (1911) urged ‘the preservation of appliances which hold honoured place in the progress of Science’, implying some items would not be preserved. How this was managed varied with time, but subject specialists presented arguments for potential acquisitions to be approved by higher authority. The Director was the Accounting Officer for the museum to the governing civil service department under which it came (the Department also varied). Purchases required public money, carefully tracked.

Introducing the Science Museum’s latest history, editor Peter Morris (2010:2-3) remarked that museums are usually associated with research as well as collections; in science museums this can take several forms. The Science Museum had a chemistry laboratory, used infrequently for small-scale pollution monitoring until the 1990s. Curators came from predominantly science-educated backgrounds up to the 1980s, from the 1920s also undertaking historical research, usually in their subject specialities and necessarily of an amateur nature until history of science became a professional qualification in the 1960s. From the 1960s curators occasionally retrained; the first professional science historians were employed in the late 1970s, affecting choices of items to be included (or not) in the collections.

The financial accounting system applied to dioramas, although they were not historical technological artefacts. Commissioned to make particular displays intelligible, they were expensive; many received inventory numbers. Following the money gave an audit trail; where the artist’s name was not included on public-facing labels, their identity might be on background paperwork. The system did not apply to dioramas funded by sponsors, a particularly creative way of keeping museum expenditure low (thesis:123,182). The artists knew their work might be unacknowledged; Roussel’s contractual arrangement obviated this somewhat (thesis:108). Dioramas were popular exhibits and featured on museum postcards; these remain collectable today, a useful source for finding individual makers.

How National Museums Scotland ‘works its past’

NMS has a more complex history than the Science Museum, amalgamating several diverse institutions. Pamphlet-sized histories and academic papers touch upon various details of the past. The only over-arching statement readily available to present-day visitors and staff is the website timeline (‘National Museums Scotland’, n.d.). The history is occasionally mentioned in the first pages of new guidebooks or catalogues; the
museum is governed by the National Heritage Act (Scotland) 1985, accountability resting with the Scottish Parliament.

As with the Science Museum, the history of the institution has little direct bearing on its day-to-day working, with some mention in collections stories. Visitor tours focus on exhibitions or collections rather than the institution history per se. For those responsible for the collections and the messages, decisions about what to acquire or dispose of depend on individual perceptions of museum policy, guided by senior staff where appropriate. To a degree this is undertaken in conjunction with the exhibition programme, so research preparing shows and obtaining objects gives a double return for time expended.

Public versions of the institution’s history have included a 1986 exhibition, The Enterprising Scot, celebrating the merger of the National Museum of Antiquities of Scotland, the Royal Scottish Museum and their smaller satellite museums the previous year. The former began as the museum of the Society of Antiquaries in 1780; the latter in 1854 as the Industrial Museum of Scotland, becoming in turn the Edinburgh Museum of Science and Art, then the Royal Scottish Museum (Calder, 1986). The accompanying book focused on Daniel and George Wilson, well-known mid-19th century Edinburgh figures; George became the first Director of the Industrial Museum of Scotland in 1854 (Ash, 1986).

The same year (1986), a 20 page (anonymous) colour guide to the ‘new’ museum featured treasures from the collections, some of which had in fact been very recently acquired. This was followed in 1989 by another exhibition, The Wealth of a Nation: in the National Museums of Scotland, an eponymous publication having a foreword by television personality and Museum Trustee Magnus Magnusson, and naming contributing authors (Calder, 1989). It included a survey of the founding histories by its Director Robert Anderson (1989), and a bibliography, naming seven component museums and the purpose-built National Museums Collection Centre, Granton, Edinburgh (current home of the crystal models).

Behind the scenes, curatorial departments had independent acquisition registration systems, a common computer database being introduced in the early 1980s. As with the other two study institutions, recorded detail varies, and is enhanced as circumstances allow through dedicated research, such as my crystal model project.

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252 My thanks to Dr Alison Morrison-Low for ready access to these publications.
Sources for recovering historical details therefore depend to a degree on archives of precedent institutions where these still exist. The Royal Society of Edinburgh (RSE) collections came to the nascent National Museums of Scotland at intervals between 1859 and 1910, illustrating several aspects of museum use and practice. Charles Waterston’s *Collections in Context* (1997) is invaluable for disentangling the story connecting the RSE, the University museum and the beginnings of a national museum of Scotland. Waterston, Keeper of Geology at the Royal Scottish Museum, a Fellow of the RSE from 1958 and its General Secretary from 1986 to 1991, was uniquely well-placed to investigate the nature and origins of the collections of the RSE, and reconstructed an inevitably partial catalogue. The first crystal models noted in the geological registers were acquired in 1816-1817, associated with the Natural History Museum of the University of Edinburgh (Insley, 2015b).

The RSE was established by Royal Charter in 1783, by which natural history specimens were housed at the Museum of the University of Edinburgh and antiquarian objects in the library of the Faculty of Advocates. The Professor of Natural History was also Keeper of the museum; it was not always clear whether any individual specimen was the property of the university, the Society, or indeed an individual collector. Collecting was by solicited gift (members searched for particular items), association (Scots acquiring items abroad brought their collections home, passing them on), unsolicited donation or purchase. The Museum flourished under Professor Alexander Walker, succeeded by Jameson in both posts in 1804 (thesis:51).

Walker believed in the utility of discovering natural history through inductive empirical study, assembling a collection of natural productions of Scotland (Waterston,1997:43-44). Jameson followed, enlarging the College Museum mineral collection, partly as Walker’s own collection was withdrawn after his death (disposal by returning to owner). An 1811 collection survey by the RSE sought to clarify which collections belonged to it rather than the University, taking transfers listed in the first five volumes of the Society’s *Transactions* as proof of receipt by the university. A second Royal Charter allowed the Society to set up its own Museum; after, specimens were kept where they accompanied research papers, 19 of 26 donations being geological, indicating contemporaneous interest in geological science.

Shifting emphasis from education to research accompanied a corresponding shift in visibility of the collections. Before, the public were charged admission; following ideas of egalitarian education (although only Glasgow’s Hunterian Museum offered free access

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in Scotland), entry became free, but depended to a large extent upon Jameson’s whim (Waterston, 1997:82-84). One person he disagreed with was Dr James Hutton, whose collection of specimens supporting his plutonist theory was one of the first acquisitions after Jameson became Keeper. As Waterston remarked:

What is not possible, without an immediate loss of value, is to make a collection made in one context conform to a collection made in a different context. It is probable that Jameson attempted to do this by extracting from Hutton’s collection such specimens as would enhance the representative collections of the college … but taken out of context, these specimens would be ranked pari passu with any other mineral or fossil. Where there was no locus within the existing reference collection for specimens speaking in another context … it would be regarded as worthless and consigned, with other similar specimens, to a storage box if not actually discarded (ibid.:44).

Hutton’s collection cannot now be identified. Waterston concluded:

Objective curation of a collection requires the purpose of its formation to be respected. The integrity of a collection will be lost if only those parts of it are preserved which can be fitted into a context of used other than that for which it was made. This does not mean that all collections should be left in their original state so that their social context is preserved. It does mean however, that records should be kept so that, if specimens from the collection are used for other purposes, it will always be possible to restore the collection to its original purposes when necessary. The values of a collection must be judged in its own context (ibid.:138).

Jameson failed to do this for Hutton’s work; arguably, he did not maintain context for his own material either. Waterston’s reconstructed catalogue of the collections from Jameson’s time omits crystal models, although some matching Jameson’s publications are present; definitive provenance of the Werner-style models is missing.

Even in an established museum, acquisition can be erratic; for example, Dr Alison Morrison-Low (2016), considering instruments of exploration, suggested curatorial interest, availability of funds, and directorial bias affected initial stages of acquisitions, citing a recent return of a long-term loan of significant material. Historical research into apparently undistinguished items in store can increase their value for material culture, publication and exhibition. Weeding can and does take place, with disposals as the most overt manifestation of official institutional forgetting.

**Disposals: Too Much Stuff, the national picture**

In 2003 the National Museums Directors Conference (NMDC), a body representing the leaders of national museums and galleries of Britain, the three national libraries and National Archives (Kew), (‘NMDC’, 2014), published a 22 page pamphlet entitled Too Much Stuff (2003). Written by the most senior national staff to contribute to sector-wide
debate about the controversial disposal question, it described past experience, present policy and practice, and an overall approach towards what should be kept or not. Careful collections review and rationalisation enhanced use and enjoyment of items retained and informed disposals, transfers or long-term loans. Their reasoning concerned collections as national assets, to be properly used; disposing of something might ensure its preservation, widen its use, place it in a context where it would be better understood and appreciated, or free up scarce resources. Within an ANT consideration of disposals, the NMDC forms a network node for national cultural institutions, individual directors also acting independently. The pamphlet *Too Much Stuff* was hugely important, both as an immutable mobile (a publication) and acting as a network node between governmental policies, individual museums and various possible disposal scenarios.

The NMDC argued for preservation by the best caretakers, whilst acknowledging risk of loss and breach of trust to donors. Issues of access to huge amounts of never-displayed material had been raised by the parliamentary Public Accounts Committee; some collections would never all be shown, particularly natural history specimens, collections of photographs (for example, those at the Imperial War Museum), the British Museum's prints and drawings, and V&A textiles. Reserve collections should be available for public benefit, and preferably also used. Transfer of British Museum photographs to the V&A giving much better access was quoted, alongside the projected transfer of the Royal Photographic Society's collection to the National Museum of Photography Film and Television (since moved again, to the V&A in 2016).

Context was key. The NMDC felt objects should be where they were best understood and most valued. Resource implications of both retention and disposal needed to be fully understood, examples including a paddle tug (National Maritime Museum), foreign newspapers (British Library), and 18th century silver (the government's Privy Council). Methods of disposal included transfer and loan. Transfer of ownership had some advantages as well as resource commitments, but finding suitable homes was challenging, some flexibility being obtainable through regularly-reviewed long-term loans. Quoted examples of destruction included plaster casts from art schools and museums in the 1950s and 1960s, resulting from 'the contempt then felt for all kinds of copies' (*Too Much Stuff*:10) (and ironic, considering the recent upsurge of interest in casts) (thesis:179), asbestos-ridden railway rolling stock from the National Railway Museum, and reburying surplus archaeological material to prevent a secondary market in un-provenanced items. Sale, for ‘trading-up’, mirrored private collectors’ activity, so better, more appropriate pieces could be acquired, or better aligning collections with
revised policies; however, evidence of other tastes and attitudes had its place and should be re-evaluated over time, as indeed has happened with plaster casts.

They considered the effect this might have on sources – gift, purchase, fieldwork and excavation. Donor motivation and funding bodies, charitable or public, widen the sense that items belong to the nation as a whole, or may carry international (and trans-boundary) importance. Arranging future gifts may become more difficult. Post-disposal regret was considered, the best mitigation being that it is unsafe to dispose of objects unless they are very well understood. More resource may be vested in items being considered for disposal than those retained. One suggestion was to select the best for disposal, as well-known, fashionable items would be valued by their new owners, so likely to remain in public view.

They summarised legal frameworks and ethical guidelines, noting the Museums Association Code of Ethics taking a more pragmatic approach to disposals in its ‘latest’ (2002) revision. Clear policies, high standards of care of title and its transfer, unambiguous procedures and a hierarchy of disposal methods sensitive to public concerns were all emphasised in Too Much Stuff, along with the requirement to document disposals and the basis on which disposal decisions were made. The Code now carries a ‘strong presumption against disposal out of the public domain’; proceeds of sales where these occur should be ‘for the benefit of the museum’s collection’ (ibid.:18-19).

With this guidance from significant nationally-funded museums and galleries, disposals in the three study institutions are considered.

**Disposals at St Paul’s Cathedral**

In the late 1970s several incidents involving disposals from church institutions were reported in the press. Cathedral Librarian, Robert Crayford, archived newspaper clippings, from which the story below is summarised.254 The Sunday Times, 3 February 1980, reported only cathedrals in the Church of England were able to sell without a diocesan faculty, the name of the consent required from the Dean and Chapter.255 In the mid-1970s, St Paul’s had sold two carved panels by the sculptor and wood carver Grinling Gibbons (1648-1721), originally sited under the organ, then stored in the crypt. The Cathedral cleared a number of unwanted items; the panels, several hundred chairs and Bodley’s war-damaged reredos were acquired by an Essex antique dealer. He sold

254 SPCAA/RC 22, Architectural Archive.
them on, after repair, buying rush-seated chairs for £6 apiece and selling them for nearer an average of £15, two going to the V&A.\textsuperscript{256}

The Cathedral noticed interest in the disposals from an article in the \textit{Architectural Journal} of 14 February 1979, remarking several items were available ‘from an Essex dealer’ at very considerable prices, and hoping that a museum could be prevailed upon to take them, rather than swelloing an existing trade in stained glass, ceramics, pulpits and pews from de-consecrated and demolished churches.\textsuperscript{257} Robert Potter, then Surveyor to the Fabric, responded the following week. The reredos was sold the previous year for a few hundred pounds although now advertised for an eye-watering £40,000; the sale helped fund a treasury display of the Cathedral's Wren models and silver plate, both the Cathedral’s Advisory Committee and curators at the Museum of London and the V&A being involved in the decisions.\textsuperscript{258}

The story revived a year later, four chandeliers with Cathedral provenance being spotted in a Mayfair antique shop. Again, Potter leapt to the defence, this time jointly with the Dean, pointing out the chandeliers had never been used in St Paul’s. The shop assembled them incorrectly; when correct, they were of a pattern the Cathedral had used since 1921 when they cost £56 each; fully working reproductions could still be obtained for £300, as opposed to £8,500 for two. The four in question came from a church destroyed during the Blitz, and kept in a vestry cupboard cleared in 1978. Neither the Surveyor nor the Dean knew how the lights had left the building, and procedures were being tightened up.\textsuperscript{259}

In the same week, the Gibbons panels were offered for sale through the \textit{International Herald Tribune}, for £20,000.\textsuperscript{260} This time the Cathedral Registrar was called to comment, explaining objects were only sold if damaged, worn out or redundant. Whether they found a buyer at that time was unclear; two years later, an advertisement in \textit{Country Life} illustrated one of the Gibbons panels in a further sale.\textsuperscript{261}

Journalists scented a story, and campaigning bodies such as the Victorian Society were ready to supply others of a similar nature. There was a feeling that antique dealers had nearly completed extracting goods for sale from English country houses, and were moving on to churches. Dealers known as ‘Church-breakers’ even specialised in

\textsuperscript{256} [cutting source not given] 10 March 1980.
\textsuperscript{257} \textit{Architectural Journal}, 1979, 14 February, p.305.
\textsuperscript{258} \textit{Architectural Journal}, 1979, 21 February, p.361.
\textsuperscript{259} \textit{The Sunday Times}, 1980, 9 March.
\textsuperscript{260} \textit{International Herald Tribune}, 1980, 3 March.
\textsuperscript{261} \textit{Country Life}, 1982, 3 June.
ecclesiastical material, advertising in the *Church Times* and offering both ready cash and confidentiality. The Victorian Society reported one who had applied to become a Diocesan Furnishings Officer, responsible for disposing of redundant fittings. The need for professional advice on commercial value, even for badly damaged items, was key.²⁶²

Current policy for the Church of England was outlined in the *Cathedral Measure*, (2011) (thesis:187). This assigned responsibility to the Cathedrals Fabric Commission for England, to advise, consider applications promoting cooperation with other heritage and educational bodies, and set standards of good practice. Individual Cathedral Chapters and the Commission jointly set up Fabric Advisory Committees, concerned with repairs that would permanently change the building’s fabric, and with architectural, archaeological, artistic, historic and archaeological matters. Specific recommendations in the *Measure* apply to Treasure, as defined by the Treasure Act of 1996, automatically involving other institutions such as the British Museum or English Heritage, using their notification procedures, facilities for inspecting proposals, and so on. Appeal and review procedures were specified.

Cathedral association, however tenuous, greatly enhances an object’s significance, hence the rise of the ‘church-breakers’. Determining precise history for Cathedral possessions is an important part of active collections review.

**Disposals at the Science Museum**

As collections grow, there is increasing pressure on storage. One solution was to obtain larger premises, another to dispose of some of the collections. Although this contravened acquisition policy as publicly understood, there has always been a procedure for disposal, criteria being damage beyond repair, or unwanted for museum purposes but with a suitable alternative home, and, less frequently, a write-off procedure for items stolen and not retrieved. The larger national museums had a long history of exchanging material to refine their holdings, the NMDC citing an exchange of ship models from the School of Naval Architecture for several hundred scientific instruments, between the Science Museum and the National Maritime Museum (now Royal Museums Greenwich).

The National Heritage Act 1983 specified the formal process for de-accessioning from national museums. Whilst maintaining a presumption of retention, items could be disposed of if they were duplicates, damaged beyond economic repair, hazardous (for instance being radioactive, or containing asbestos) or deemed to be ‘no longer suitable

for museum purposes’. The mechanism was a Board of Survey, a committee of senior curators, conservators and administrators, to inspect objects and attendant paperwork along with arguments justifying disposal, and selecting the disposal method. Boards were convened as required; generally the spur would be a gallery closure, or movement of objects from one place to another, either case facilitating inspection for deterioration or damage.

During the later 20th century, disposal issues became much more public, high profile sales of artwork from galleries attracting vociferous disapprobation from (artistically-aware) media. Part of the outcry concerned the secrecy with which disposals were made. Getting rid (or letting go) of a high-value piece to provide maintenance funds for a crumbling building contravened professional ethics, and professional museum bodies began to address the issue, both nationally and internationally.

Collections rationalisation could happen without hullaballoo if processes were open and transparent. For the Science Museum in the early 21st century, I organised a survey at the large object facility at Wroughton, Wiltshire, to identify potential disposal items. Loans were first offered back to the original owner; finding suitable alternative homes either within the museum group or in the wider museum sector came before sale into the private market, or ultimately, local authority disposal. Where objects were disposed of, their stories were retained. As remarked above, determining the significance of things considered for disposal could involve more research than acquisition. Significance was fundamental; the more background information about an object, the easier to decide whether it was significant enough to retain. Something in glorious condition but wildly irrelevant would be found a new home. Applying this to dioramas required their histories to be clarified; as these became better known, there was an observable shift in appreciation of significance. One vital aspect of my research was clarifying the importance of the dioramas and their makers; I was consulted informally by curators for both the galleries featuring dioramas before they closed in 2016.

No Science Museum gallery remains themed around dioramas as a display technique, their role being overtaken by film and televisual media, and increasingly electronic provision of computer-generated visuals and interactives. The ultimate destinies of dioramas from the Agriculture and Medical Galleries remain unclear.

**Disposals at National Museums Scotland**

Setting up Scotland’s National Museum involved acquiring other institutions’ collections, withdrawal of loaned personal collections, and replacing or repairing decayed or
damaged items. Jameson rebuilt the mineralogy collection, but refusing access to Hutton’s collection whilst failing to keep it together:

Curatorial experience suggests that Jameson’s failure in his guardianship of the Hutton Collection may have been even more insidious than muddle or even malice but lay rather in his inability to respect the intellectual context in which it was formed and in which it was intended to be used (Waterston, 1997:43).

Waterston described the final report of the RSE’s disposal of its last collections in 1910 as a ‘masterpiece of imprecision’, with ‘Sundry specimens [being] selected by the Director of the Royal Scottish Museum’ (ibid.:132-3). Departmental documentation may note what was selected.

Manuscript registers recorded items lost or written off, and form a valuable primary source for collection historians. The replacement computer database holds information about what is in the collections. However, one published story is salutary, concerning photographs in the World Culture department but with wider relevance. Dr Knowles (2014) related that although some significant photographs and albums were registered in the collections, a mass of other images were associated with registered items in various ways, but stored elsewhere – library, archives, departments, object files, or even alongside their objects in store but unrecorded. Most dated from the mid-1970s onwards; there must have been very much more material in earlier years. Her focus was on disposals of some during the first half of the 20th century, and wholesale removal of the rest in 1959. This is a ‘noisy silence’ indeed (Linde, 2009).

Purchased photographs were registered, accounting for the payment. Donated photographs were often noted in an unofficial ‘X-register’, established to track items not formally added to the collection. These could be objects on display whose provenance was lost, but grew to include transient items which could be disposed of without fuss. From the late 19th century photographs were marginalised, with a lack of an audit trail. X-registration recorded items but offered no safeguards; information was imprecise and items could be removed at will for exchange or ‘trading-up’.

The Disposal Board for 1959 considered 135 registered items, of which an astonishing 114 were photographic collections, each containing between 1 and 332 separate photographs. With the exception of four lots, all were destroyed or marked for ‘museum use’. Although ‘something drove the acquisition of photographs, their consideration once part of the collections was negligible’ (Knowles, 2014:78). 100 collections of X-registered photographs had been disposed of five years earlier, without the formality of a Disposal Board. That this could happen was attributed to the ambivalence of the institution at the time to photographs as material evidence and the lack of curatorial
engagement with them, even for display (as seen in the few images of exhibitions of the time). Walter Benjamin’s suggestion that photographs lack ‘aura’ and therefore authenticity or perceived significance was exemplified (thesis:32-33). Registered items were ranked; donors and donations were noted in annual reports, but purchases rarely.

Photographs were used in lectures and occasional exhibitions, constantly reviewed and redefined through their geographical location in the building, and readily lent out, implying they were readily reproducible or replaceable. Copy negatives would be made twice in a photograph’s active life. First, at registration, the owners allowed access for the museum to make selective copies, registered as unique numbered objects, sometimes showing original context (edges of album pages etc.). Second, reproductions might be required for lecture slides, exhibition prints or publication. Photographs of graphic panels gave glimpses of captions, indicating what aspect of the photograph was regarded as significant, but transforming the originals from artefact to information, undermining the nature of their value. Information was valued more highly than the photograph as artefact.

Post-war rationalisation and modernist attitudes to display resulted in a drastic reduction of the amount of material on show. The shift from extracting war-damaged material to on-going rationalisation included a re-evaluation of what was authentic and what was reproduction or fake. Whereas engineering and ship models flourished, photographs and plaster casts became irrelevant. The 1950s cull aimed to improve quality and refine scope. Some curators had reservations – a Hawaiian boat model, listed as destroyed in 1948, was actually transferred to another museum. The emerging tension between curators and management over considerations of value and knowledge-making did not extend then to photographs. Objects were considered aesthetically; photographs lacked aesthetic value, and disappeared.

It is worth remembering photography was originally hailed as a replacement for art – when daguerrotypes were first shown publicly in 1839, Delaroche famously exclaimed ‘From today painting is dead!’ As photographic techniques developed, photographs were collected both for record and aesthetic reasons, and for commercial public sale. The British Museum employed a photographer from 1853 (Lesic, 2012:87). The Tate has acquired photographs, and photographs of art, since 1860; the South Kensington Museum sent photographs out in travelling exhibitions as the next best thing to the works of art they illustrated (ibid.:72). As with plaster casts, attitudes to copies fluctuated over time – the Wallace Collection in 1901 formally objected to replicating collection items for fear of fraud, whereas for the South Kensington Museum, selling measured
drawings ensured future copies would be as accurate as possible, authenticating good design. For Walter Benjamin in 1935, the invention of photography transformed art, democratising culture and artistic production. ‘Cult’ value of original art was replaced by ‘exhibition’ value, even for photographs as works of art in their own right (Walker, 1983/1998:74). Exhibitions today celebrate multiple aspects of photographs as objects – aesthetic value associated with named photographers and technique, as well as documentary record (particularly for items that no longer exist).

Present-day practice at NMS sees photographs returned to permanent collections, but not necessarily to the registers. Historic photographs are reunited with their accession numbers and locations. Absence created by active destruction as opposed to neglect or passivity contradicts what the museum stands for. Curators grappling with absences aim to create presences for all that remains, demonstrating relevance and active research potential.

4.2 Unofficial forgetting

Within Institutions

Within institutions of official memory, there are many ways of official forgetting. Coping with the impact of mergers of collections, selective retention from potentially duplicate items, replacing items withdrawn to maintain the overall worth of the collection, considering methods of trading-up such as exchanges, re-homing more appropriately items that no longer fit the changing priorities of a developing institution, whilst having an eye to cultural, curatorial and ethical considerations as cultural leaders – disposal is never simple but requires careful and sensitive management using the fullest information about the item under consideration. As actors in ANT, institutions exert force through determining policies, procedures and therefore the actions of employees even where they disagree.

Unofficial forgetting happens anywhere in the hierarchy but being less visible may or may not be noticed in normal management practice. For instance, Wren regularly hid drawings from critics, to avoid wasting time; historians have found them in other repositories. The identity of the Cleere brothers as makers of the Great Model would have been very well known at the time, but their relative insignificance compared to Wren would have made them less memorable to individuals. The Wren Cathedral was itself built on the site of the previous cathedral; rubble from the former building was used to fill the piers of the new structure. Today, if samples of these older stones are extracted during repair work they are treated respectfully, as evidence from the past. I
am not aware of remains of the previous museum building in Chambers St, Edinburgh, being retained by the present museum.

An archaeological approach to old masonry was taken during foundation excavations at St Paul’s in both 1911 and 1933. The diggings attempted to identify the structure of the building and the nature of the soil below; findings were noted and photographed. Lists of these photographs were made, and some photocopies found, but not the notebook containing the records. The 1933 excavations resulted in a set of drawings, a formal report, a photo album showing subsoil structure, geological models of each pit, and a landscape model of the surrounding area with removable sections and two sub-base layers to show underlying geology. The table-top sized model has been moved around the storage areas of the Cathedral, and is in need of conservation. Boreholes set around the city for water level monitoring are no longer actively used, although several remain in situ. The reason for remembering has been forgotten (Plate 29).

Component parts were preserved, but not the context. Fragments were separated from the archive that clarifies their identities. In Edinburgh, according to Waterston, Professor Jameson purposely distributed the specimens representing Hutton’s ideas through the collection; the pieces informing his theories cannot be reassembled. Administrators of any archive, library or collection will experience issues to do with completeness of cataloguing, recording relevant information, completing rearrangements of material, and problems when material is divided between locations or institutions – keeping track of locations in particular is a Herculean task. I have experienced these difficulties in all three of the study institutions, and in other libraries.

A different kind of problem arises when insufficient information is recorded. Some donors of hobby models of the Cathedral are named, but nothing else known about them. This may also arise from data protection and the 50 year rule for access to archives. Some names are not recorded at all. Models made by secular workpeople have not been acknowledged, although occasionally they can subsequently be identified, as with Mr Bolwell’s model of the cone and lantern.

Even where the names are famous or high status, the stories themselves can become so intricate it is nearly impossible to disentangle what happened, such as the details of liaison between Penrose, Triqueti, Woodington, Leighton and Poynter, negotiating the mosaic decoration design. Where an individual works on more than one job, details are complex – as for both Stevens (the Wellington monument and the dome) and Paternoster Partnership (detailing the area surrounding the Cathedral as well as the
1. Geological model of the area around St Paul's Cathedral, 1933 [SPCAA]

2. Albums of drawings of test pits [SPCAA]

3. …sections [SPCAA],

4. …photographs [SPCAA],

5. …individual models [SPCAA],

6. …and inconspicuous borehole covers
Choir School). For large projects which have gone to competition, the models (where these were even allowed) may remain for a time with the architect designers, but turn up later in public collections lacking detail of why and when they were made (the Mitsubishi Cathedral model, donated to the Cathedral, and the London County Record Office model, currently at LMA).

Models lose their purpose when different ways of working come to the fore. Within the Cathedral, Feilden’s 1970 perspex model of the Cathedral was not used by his successor Baxter, who also ended the practice of using crack micrometers to record the state of the fabric, preferring more efficient electronic measurements. Crystal models, whilst remaining a valid representation of external shape, have nonetheless been replaced within the science they illuminated by other techniques of visualisation, interest shifting to internal structure and construction. Displaying dioramas is now considered (if at all) alongside other exhibition types, many of which are thought more engaging, or attractive, through movement, interactivity, and so on.

**Within society**

The futures of the collections studied in this thesis lie with people whose memories, perceptions and values are culturally determined and affected by the society in which they live. In considering ways in which the models and their makers have dropped from public gaze, the societal background within which this dropping has occurred must be taken into account.

Paul Connerton, in two books two decades apart, studied how individuals select what to remember or forget related to the value placed on memory by their society (1989:2009). The second, *How Modernity Forgets*, begins by noting that the topic of memory is ubiquitous, quoting heritage, museology, retrochic, holocaust memorials and industrial archaeology as current cultural memory. His major claim is that modernity has a problem with forgetting, quoting, amongst others, Hobsbawm: 'The destruction of the past or of special mechanisms that link one’s contemporary experience to that of earlier generations is one of the most characteristic and eerie phenomena of the late 20th century' (Hobsbawm,1994:3).

Connerton defined modernity as the objective transformation of social fabric unleashed by the advent of global capitalism, removing limitations on a global scale, and psychologically enlarging life chances released from fixed status hierarchies. He went on: ‘to say modernity is characterised by a particular type of forgetfulness presupposes

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a conception of remembering’ (2009:4), focusing on place memory (memory based on topography, as detailed by Frances Yates), (thesis:33) temporalities and topographies of forgetting, and how these reinforced each other.

Within place memory, the method of loci uses a stable, well-known or imagined place at human scale as a pictorial grid used to order the images to be remembered. Forgetting is associated with processes separating social life from locality and human dimensions – speed, unwalkable megacities, consumerism dislocated from labour, and short-lived urban architecture. Generating shared meaning in shared memories, through living and working together in a world of known social relationships, is forgotten. Connerton distinguished between the memorial and the locus (2009:7-39). Memorials, such as place names (carrying meanings even if forgotten), or ceremonies (bodily actions conducted in specific places), can substitute for memory. Significance of a locus, such as a house (its mnemonic possibilities arising from a stable, bounded layout and history) or a street (having social purpose for living and working, but walkable, with intersections encouraging interactions) builds up over time, but can be taken for granted. For the collections under study, I suggest that the buildings housing the collections act as loci of remembering, with grand museums and the Cathedral being landmarks in their own localities.

Considering temporalities of forgetting (ibid.:40-98), Connerton drew distinctions between the time occupied by the labour process, consumption, career structures, and information and media products, each abbreviating history and encouraging cultural forgetting. Detail of labour involved in making is first to be forgotten, in a kind of cultural amnesia; objects once out of the hands of their makers take on lives of their own (ibid.:42). The models in the collections outlived their makers, and in many cases their first users also, with their processes of construction being forgotten.

Relationships embedded in the flow of merchandise are forgotten at a societal scale. Where and how goods were made became irrelevant. Buying them was a commodity exchange, not a gift exchange with memory claims of obligation (giving, receiving and reciprocating). In commodity exchange, use-value shifts to exchange-value, with shortened lifetimes based around fashion, and obsolescence involving discarding. Shiner also uses this idea (as the French literary historian Annie Becq developed it) in discussing changes in the arts from patronage to market (2001:127). Pre-industrialist acquisition of technical skill was achieved by watching; transactions took time. Until the 1970s the organisational structure for a working life was fulltime work from adolescence to old age (ibid.:67-78) . This has now fractured, and concepts of historical continuity,
cultural trust and stable career structures were lost. ‘Postmodernism… causes the past to lose its historicity, by reducing it to a repertoire of contextless and arbitrarily exploitable forms’, and ‘what is remembered becomes ever more obsolete with respect to its specific applicability to the life experience of work’ (Connerton, 2009:78). Following this train of thought, a remark (made in a conversation which I cannot attribute formally for ethical reasons) suggesting the perceived worth of models depends on whether others value them enough to help sponsor their upkeep is understandable, even if one disagrees with the reasoning.

Connerton discussed mass communication media. Numerous or dispersed readers of newspapers shared identical texts, which hold relations in place as do documents and models dispersed as immutable mobiles in an actor-network (thesis:39). Reading fragments of news involved both reinforcement and loss of memory, the reader being informed but not involved with actual events. Even more with television, the world appeared dematerialised, the present experienced as a narrowly-defined moment unlinked from past cause (Connerton, 2009:78-87). Different types of forgetting act together; forgetting becomes systematic.

Considering topographies of forgetting, Connerton explored how contemporary scale, speed and repeated destruction of the built environment produced spaces affecting transmission of cultural memory (ibid.:98-125). Today’s metropolitan areas are huge with decentralised and dispersed transport infrastructure. The method of foci as a memory guide no longer works. Homes were also unstable. Workers’ homes in the 1840s were built with an anticipated life of 40 years, reduced to 30 years by 1936, with possible renewal for a further 30 years, so could no longer act as loci for long term memory transmission (ibid.:117). Modernity produces cultural amnesia intrinsically and necessarily, and forgetting is built in to the capitalist process of production itself.

Connerton concluded that cultural forgetting is accelerating (ibid.:139-147). Cognitive, personal and habit memories interweave and reinforce, but all are threatened. Goods and services depend on linkages to unknown or insignificant people and places (cognitive); shorter product life cycles risk cultural forgetting of both personal and habitual memories. Modern information is disseminated in ways that emphasise the new, the brief, and the discrete, affecting perception. At work, 21st century technologies increasingly devalue memory of habitual skills – personal memories are no longer useful, corporate memory of links between person and work forgotten. The culture of mechanical reproduction produces memory differently, with metaphors around the act of writing (trace, impression, background, layering). Electronic images do not inspire high
valuation and encourage discarding, weakening the cultural value of personal memory. Paradoxically, intensive archivalisation (his word) has led to an excess of cultural memory. Comparing this to the way we actually live led Connerton to claim that the political economic system is generating a modernity that forgets.

Summary

Factors affecting processes of remembering and forgetting within the institutions depend on present-day practices. Presenting their own histories to current audiences involves selection of what is told; models appear infrequently (the Great Model at St Paul’s excepted), either in the stories told, or on display. Once removed from display, models are readily forgotten, although their occasional rediscovery can result in moments of higher visibility. Documentary access is constrained by issues of Data Protection, Freedom of Information rules, the contents and structure of electronic databases, remoteness of archives; front of house staff have variable knowledges about institution holdings. Where the makers were not formally employed as members of staff, information is hard to find. Decisions of what to preserve determine how information is recorded (or not), the value placed on the item in question being key. Procedures change over time; earlier data capture was sometimes inadequate, for a variety of reasons from overwork, to personal disagreement. At various times, curatorial interest, directorial bias and availability of funds have been identified as controlling factors.

All three institutions had active policies for collection care, covering storage and exhibition. A national overview on disposal, assembled by a committee of the Directors of top UK museums and galleries, gave a useful review of arguments and sensitivities, including institutional attitudes to copies (including plaster casts), mindfulness of professional ethics, the effect of disposals on possible future acquisitions, and the desire to be able to re-present former or out-of-date practices. Provenance and association carry monetary as well as cultural values, and disposals can be performed without forgetting – again, documentation is key. Studying institutions’ disposals showed ambivalence to certain types of material (furniture, photographs) and different approaches to openness about disposal methods and impacts arising from loss of context. Connerton’s studies of remembering and forgetting (human actors in these networks being influenced by the wider societies in which they live) identified methods of remembering, and how these can disintegrate. Place memory (things being moved around), familiarity with processes and the reasons for them (such as leaving notes when something is borrowed) and the speed of change all contribute to decreasing value of memory skills.
5. Conclusions

I examined three model collections, in two national museums and a cathedral, becoming surprised by the absence of information I expected to find in the owner institutions. My resulting research questions concerned possible factors for this absence, and how models passed from being visible and valued (firstly by the original owners, then by heritage institutions) to being set aside, rendered invisible and risking permanent disposal. I considered what others thought about the role of things, and models in particular, with aspects of Actor-Network Theory underpinning the work (thesis:38-44). Similar questions applied to the makers – who they were, how they acquired necessary skills, how they were regarded by clients and later audiences for their work. I considered how practices of remembrance and cultural signification at the owner institutions, responsible for official memory in various ways, changed over time.

Although the models still survive (for now), I discovered their makers are not remembered by the custodians. NMS natural science curators did not know who made their crystal models. If the architectural models at St Paul’s Cathedral carried a name, it was the architect’s. Science Museum curators would read signatures on the dioramas but knew little else about them. There is a current upsurge of interest in making things – television programmes, exhibitions and craft workshops proliferate, my own university UCL has a new Institute of Making – so reviving stories of these models and makers is timely, before they disappear altogether. As Hobsbawm remarked, history from below extracts the contribution of overlooked people, providing a link with the present (thesis: 27). Here, this comes from surviving models, whose continued existence is an issue for the present to resolve.

I review my findings, consider whether I have found answers to my research questions, the utility of ANT, the impact of my work in the process, whether situations of invisibility occur elsewhere in the various subject areas the study collections could be situated within, and examples of regained visibility for these and similar artefacts today.

Acquiring models

The models are three-dimensional, and representational. Crystal models are larger, idealised versions of smaller, irregular, naturally-occurring mineral specimens. Architectural models demonstrate aspects of construction, and how finished structures might look, usually at smaller scale. Diorama scenes present a foreground containing the item or process of interest and contextual background. Whether acquired or commissioned, at the time of acquisition, the models were desired.
Institutions own them now; original ownership of individual pieces could be rather different. The earliest crystal models in the NMS collection were probably Jameson’s personal property, passing to university and then museum ownership in a multi-step process over many years (thesis:53,192). Later acquisitions were made institutionally, with varying attention to provenance. The architectural models at St Paul’s were mainly architect-initiated, Wren having commissioned the Great Model to inform his client, and others such as the Macartney models resolving questions of structure (thesis:89-93). Ownership was sometimes unclear (thesis:82,86). Other post-build models made and given by hobbyists were accepted with varying attention to provenance. The Science Museum dioramas were mainly commissioned in-house, some being sponsored by outside bodies which technically owned them unless or until they were given to the museum (thesis:123). One, *Horse Ploughing*, in the Agricultural Engineering Collection, was acquired from the family of the artist, Tom Ivester Lloyd, some years after his death (ibid.).

Acquisition was purposeful. Crystal models showed crystal shape more clearly, part of learning about the material world. Cost was adjusted to suit the owner’s requirements – artificial stone or finely carved timber for the rich; self-cut, traced and glued paper for the autodidact mechanic. Scale and material were selected to meet the scholar’s needs. Architectural models could be beautifully made to impress, or in a more workaday manner suitable for less considerate handling. Dioramas were specified for particular exhibitions, part of larger stories for educational rather than aesthetic value.

Another early query was how the makers were found – people able to understand what was wanted, and to create it. Making models was collaborative. Where people generating the idea and doing the making were different, they had to work together to achieve a good result; problems of manufacture were solved jointly. Thinking in 2D and thinking in 3D are not the same; I had assumed sketches came before the model, but in 1772 Romé de l’Isle’s engraver requested models of crystal shapes in order to prepare plates for the accompanying book. An added complication was that he had to work in reverse to produce the copper plates (thesis:69). Making models in terracotta, Romé de l’Isle’s student Carangeot adapted a tool from the ceramic works at Sèvres, (thus inventing a new scientific instrument) (thesis:65,164-6). Production was not straightforward; neither was assigning credit. Despite J J Griffin’s biscuit porcelain models of 1841 being clearly acknowledged in his accompanying book to follow the system of Gustav Rose, they were not recorded at acquisition as having any particular association beyond Griffin himself (thesis:55). The trail from original idea to DIY paper
crystal models was an intricate and lengthy one, with the eventual actual maker remaining unknown and unnamed (Insley, 2017).

For scientists employed in academy or university, technical help would be available; otherwise, personal servants might be roped in to assist if they had suitable skills. In a rare example where the maker of crystal models was known, Hauy in Paris in the 1810s housed his technician Beloeuf on site during the years it took to complete the enormous crystal sets representing his mineralogical system (thesis:69). Architects in training were often expected to model their master’s designs. Robert Whellock at St Paul’s remained invisible over a century after producing his work (thesis:84-85). The Science Museum diorama artists emerged at the British Empire Exhibition, Wembley, being contracted alongside full-time employment at the Imperial Institute. The commissioning curators saw how effective and attractive dioramas were, and sought out the makers to do similar work for their own institutions.

Considering how someone became a (professional) model maker, one surprise from this research was the realisation that ability to draw and make models was relatively widespread. Early 19th century primary education included drawing, even if restricted to drawing letters as a preliminary to writing, and even if the teacher was a slightly older pupil from the same school (thesis:147). Building things was integral to children’s play, from making shapes out of mud, to block toys. I found a thought-provoking link between block toys and crystallography in Froebel’s development of the Kindergarten (Insley, 2015a). After primary school, manual training aimed to turn children into dextrous apprentices for their intended working lives. Drawing lessons were widely available for people not intending to use this skill for paid employment, notably including women (Bermingham, 2000), a point I return to below.

Children’s instructional literature of the period included handbooks on how to draw, with emphasis on mastery of perspective as a drawing technique. This was useful for rendering crystal shapes two-dimensional, creating convincing backdrops for models having themselves either true or skewed perspectives, and for architects’ drawings of future buildings. As ever, the detail is more complex. Penfield (1905) commented that in drawing crystal shapes, the eye was usually regarded as being an infinite distance from the object (all parallel edges on a crystal appear parallel in the drawing), so true perspective (where parallel lines meet in a distance) is lost. Drawing a crystal shape successfully depended on good understanding of both shape and projections on the page (thesis:70-71). According to Roussel, backgrounds to dioramas required very careful setting out as the viewer had multiple viewing positions (Whatman, 1959). Artists
working on backgrounds to specimens in the Hall of African Mammals (opened in 1936 in the American Museum of Natural History, New York), and to memorial dioramas in Canberra, Australia, from 1918 onwards, took this very seriously (Quinn, 2006:149; Back and Webster, 2008:9). Architects’ perspectives attracted similar discussion about their ability to deceive the client about the final look of the new building as occasionally applied to models (thesis:158).

Ability to draw has not always been highly regarded in society. In 1754, Robert Adam hid his sketchbook from his clients rather than be seen drawing, although the resulting print books were acclaimed best sellers (Adamson, 2013:18). Drawing was an acceptable ‘polite’ occupation for ladies (Birmingham, 2000), and it was also socially acceptable to employ, or be, a drawing master. John Varley, Delvalle Lowry’s husband (thesis:54), was a successful drawing instructor to a number of artists who later became well-known (‘John Varley’, 2018). The diorama makers considered themselves artists; many were formally trained, several being teachers or trainers (thesis:160).

Two-dimensional work by some of the makers has survived, notably posters for travel companies produced by diorama artists. A poster by Roussel in the V&A is remarkably similar to an unfinished diorama of a village in East Africa in NMS; his paintings are auctioned occasionally (thesis:104). Whatley and Black also produced posters; Black designed a striking series of angled aerial perspective maps of railway networks, while Whatley’s graphics of scenery are also notable (thesis:106,160). Ivester Lloyd illustrated books on horses and hounds, sometimes collaborating with other members of his family; Robertson eventually became so successful producing book jackets that he gave up diorama-making. Cawood illustrated the Science Museum guidebook for the Introductory Gallery. Some diorama files contain preliminary sketches.

Acquiring skills in 3D model making could be through formal or informal education. John Flaxman, son of a plaster cast manufacturer and winner of prizes for art from 1767 aged eleven, went on to design for Wedgwood, at a time when hierarchies of manual trades were being reordered to take account of growing use of machines in mass production (thesis:153). Formal manual training previously was through the guilds, but as new ways of working became more widespread, this control slackened. A growing number of publications, such as Diderot’s *Encyclopédie* (1751 onwards), described Industrial processes, helping to democratise manufacture. Manual or handicraft training in secondary and further education was extended through a system of National Schools after the Great Exhibition (1851), where British products were compared with those of other countries; new methods of education were developed to meet demand
Training in architectural modelling could be through learning on the job as carpenters or joiners on building projects (thesis:157-160), or by pupillage with a practising architect (as with Whellock and Penrose at St Paul’s Cathedral) (thesis:79).

Self-help for mechanics in the 19th century is well-known, but not the examples found here. A sizeable section of crystallographic texts through the 19th century featured instructions to the (anonymous) reader, giving plans of folded-out crystal shapes, instructions how to enlarge a drawing if required, and to fold and glue it to give a (fragile) model for personal handling whilst reading the text (Insley, 2017). The growth of Mechanics’ Institutes from 1824 onwards, labour unions and working men’s clubs (Hopkins,1995; Inkster,1985), Griffin’s efforts to make science available to interested artisans through inexpensive books and equipment (thesis:57), articles in The Builder in 1862 for the aspiring ‘artist-workman’ (a designation combining usually exclusive terms) (thesis:156-157), all give testimony to enthusiasm and determination for betterment amongst artisans. The 1824 inaugural meeting of the London Mechanics Society attracted 2000 attendees (thesis:151).

Further evidence of democratisation can be seen in the materials used. High-end crystal models were made to look good and be resistant to a certain amount of handling – a medium density wood would take a cut and maintain a sharp edge; artificial stone, alabaster or plaster could be cast or carved. Top quality sets were provided in custom-made cabinets (the Ferguson of Raith set, NMS) (thesis:64), or matched library bindings (Romé de l'Isle’s set, Science Museum) (thesis:69-70, plate 9). Werner’s sets were numerous but small, and probably hand-carved. At the other end of the scale were paper and card models, for copying and making up at home. Once paper became cheap, it was used extensively for fancy goods of all sorts, catering to the rapidly growing middle classes. There are card examples of all three types of model in these collections, plus notably Thomas Wilby’s Great Exhibition model of St Paul’s Cathedral, now languishing unrecognised in a remote V&A store (Leslie, 2004:169).264

Until recently, respect for craft skill has not been high within the institutions; cited works in the bibliography of craft history produced by the V&A in 2016 reflected this strongly amongst practitioners (‘Crafts’, 2016). More public attention is being directed at how things are made, in V&A exhibitions (Power of Making, 2011; Opus Anglicanum, 2016), and UCL’s Institute of Making from 2013. But alongside new materials and techniques, the exhibitions include examples of traditional or historical items with structure or

264 The V & A database cites SCP.LOST.271 and SCP.LOST.820 as models in card of St Paul’s Cathedral and St Bartholomew’s Hospital, donated by Francis Wilby in 1879 (thesis:145-146).
function (or both) still in use today – whether pottery or plastic, a drinking vessel works. Considering manufacturing processes, Paul Greenhalgh remarked that up to 1914, and after over a hundred years of industrialisation, most objects made in Britain included some hand work (thesis:174). New methods and materials do not make earlier ones instantly fall out of use. For the model types in this thesis, this holds true, both for materials (plastic does not eliminate the utility of card) (thesis:45) and for pedagogic and other purposes to which the models could be applied.

**Attitudes to models**

Do these models count as art? Writing in the 1980s, Williams remarked ‘the category of ‘art’ is normally and even insistently applied to works which have no other purpose but to be works of art’ (Williams, 1981/1986:122). As a former technological museum curator, I am not uncomfortable with the same object appearing in more than one category, being switched from one category to another, or being assigned to several simultaneously. The models did have other purpose – they were specifically designed to illustrate. Dioramas were made for specific exhibitions, details of the scene content agreed collaboratively. Roussel was acknowledged by name by senior museum staff as an originator, a pioneer of diorama making, even after his death (thesis:110). The architectural models, with the exception of the Great Model (which predates and does not show the final form of the Cathedral), showed parts of the existing building; individual artistic thinking only concerned the decoration to be applied. Crystal models were probably made one at a time, with more complex ones taking several days (thesis:65); scope for either individual flair or machine assistance was limited, although a lathe was adapted from tools for mineralogical specimen shaping in the 1900s (Goldschmidt, 1908), and another in the 1960s to make thirty or more identical shapes for student handling (thesis:67). Apart from the last example, the models were not mass-produced (identical things made in one production run). Each item was individual, even if general features fitted an overall pattern (sizes of showcases on galleries, being narrow enough to get through the passageways of the Cathedral, small enough to be handled by available people and stored conveniently).

During their first active lifetimes, how were the models regarded? Each type was intended to play a part in something bigger. Crystal models gave tangible authority to systems of crystallography being explained to students, architectural models were components of building construction and maintenance (with some hobby homage afterwards), and dioramas gave context to exhibitions based on wider themes. At manufacture, the models were valued (and in monetary terms – they had a cost). Once
completed, their perceived value was a controlling factor for their on-going visibility. Expensive ones would be handled carefully, as prestige collection items, and shown off to appreciative audiences. The spectacle would be memorable, the purpose was met, and the models’ cultural value would be enhanced. Even if not on public display, their existence was known, and remembered. Culturally and socially, access for audiences to models was controlled by their commissioners, who tended to have higher social status and greater wealth than the makers, or with institutional responsibilities, working in increasingly professional ways.

Models had both advantages and disadvantages. For instance, as a way of choosing the final decoration of St Paul’s Cathedral, reduced scale models could hide imperfections as well as reveal them; colour might not be true to the final full size effect (thesis:82-84). Other diorama forms include habitat dioramas, with interest from the 1990s led by Karen Wonders (1992). Her negative opinion of non-biological scenes was one incentive for this study, as I strongly disagreed with her unreferenced remark that dioramas without specimens from life were less convincing than those that did have them (thesis:17), echoing Constable’s remarks that painted scenes in Daguerre’s Diorama failed to deceive the eye (thesis:42).

Another factor in how models were viewed was that they were indeed models, and therefore to a degree ‘inauthentic’, an idea from the wider world of art history and analyses of modernity (thesis:32-33). But the models have their own material reality; the issue that they were somehow not ‘real’, and therefore lower status than other collection items, manifested itself in different ways and at different times. The attitudes shown by the V&A at various times to plasters casts is a telling example; the Cast Courts reopened in 2014 and 2018, redisplaying such astonishing plaster copies as Trajan’s Column (thesis:176); recent academic attention to plaster casts has been noted elsewhere (thesis:176-178). Produced for a purpose, any model was as real as it needed to be. Dioramas represented the inaccessible, or dangerous, or too expensive, or unavailable. Crystallographic specimens were recorded and studied with more care than models intended to be handled and readily replaced. The structural models for St Paul’s had a relatively short active life, then were stored, not discarded. Dioramas, showing scenes otherwise beyond the immediate experience of the visitor, could have long active lives in the galleries for which they were made. When those galleries closed, dioramas were considered as individual artefacts of debatable cultural value – their original context had vanished.
Reviewing a model as an example of its creator’s work happens when it is considered for disposal (thesis:195). All the institutions have a presumption of retention (only pieces of least value are discarded). Disposal managers inspect objects more closely then, and attempt to foresee other potential uses, based on available evidence. My concern has been to show that where makers’ identities can be discovered, these hidden histories contain previously unappreciated links between objects, and greater knowledge enhances display options. After Roussel’s death, for instance, the Commonwealth Institute held a commemorative exhibition of his paintings (Bowen, 1968).

These institutions are official sites of memorialisation, with authority to select what is important, often in inexplicit ways. The Cathedral’s main focus is not its collections, although these have important roles in ceremony and maintenance. Museums, however, are official sites of preservation for culturally significant objects (a designation shifting with time), and committed to making them accessible to audiences. My investigations confirmed that institutions forget as well as remember. How this happens, both officially (through how they work their pasts, and their policies of disposal and acquisition) and unofficially (through attitudes and actions of individuals), makes retrieving object stories difficult. I should note here that within the museum sector, there is a move towards greater openness about reasons behind decisions, a more radical transparency. As noted by Marstine (2011:14-17), museums are perceived as trusted sources of information. The extent to which information is missing, partial, or even wrong was one of the drivers for my research, and improving the historic and contemporary record a key desired achievement. I give examples in the rest of this section.

Value judgements of the culturally significant shift with time; surviving artefacts illuminate both our own attitudes and those of the past. For instance, Roussel’s ox-ploughing scene shows a mid-20th century interpretation of 14th century rural activity. In the source Psalter, individual images were randomly placed and wildly out of scale. History is never finished; as Richard Chartres [Bishop of London] remarked, ‘we cannot change the past but how we remember it is desperately important’ (Turner, 2015/2016:7. Reviewing evidence for what happened allows fresh insights to emerge (Mortimer, 2010/2012), and reviewing present activity and decisions will facilitate future histories in ways we cannot know.

The need to accommodate new material pressurises disposal; display lifetimes vary. For NMS’s crystal models, owned from 1816 onwards, the most public visibility was arguably the Crystallographic Gallery of 1912, still in place in 1917, and with
accompanying catalogues. Exposure for the Cathedral’s architectural models could be measured in days, except for the Great Model, still on show after nearly 350 years. Science Museum dioramas were in 2018 finally removed wholesale from exhibition, after active use in display for nearly ninety years. There has always been competition within exhibitions for lively or interactive display techniques. Today is no exception, given nearly ubiquitous electronic content on personal equipment. There is nostalgia for 3D models, but I have on one occasion met a younger person who did not know what a 3D model was – the digital is so pervasive it changes how we understand the world. It becomes increasingly difficult to justify retention without knowing what the models are and how they came to exist in the first place. But where behind-the-scenes information is made available, it can be popular. In documentaries such as the BBC’s *Blue Planet*, a final segment shows how the crew adapted their cameras, travelled to the right place or overcame other struggles to achieve the perfect shot. Perfection is not effortless.

Seeking evidence of audience reactions was not a major feature of the present study, but examples include 19th century reports on the Cathedral architectural models for redecoration, which were published, printed and distributed lavishly (thesis:82); an archive note in Imperial College describing how Professor Cullis (tenured from 1923 to 1937) could hold the attention of a geology class of diffident miners with his dexterity in handling crystal models, which he practiced in front of a mirror; and reports by the Museums Correspondent of *The Times* on new dioramas installed in the Imperial Institute (thesis:106). In contrast, the startlingly pristine appearance of many crystal models in the Raith Haüy set (thesis:64), housed in its own dedicated cabinet, suggests it was never much used. Self-assembled paper models might well disintegrate after relatively short usage. Dioramas were certainly attractive to the general public, given reported increases in visitor figures as they were announced, and attendances to galleries where they were displayed. In ANT terminology, they exerted force; even if I, like Jordanova (thesis:30), deny inanimate objects agency, I am not alone in happily devoting research time to their study.

**Authorship, authenticity, aura and acknowledgement**

In the early 19th century, London’s Royal Academy elevated painters in oils to the top of the artistic hierarchy. Paris’s Louvre (opened in 1793) was administered by painters, individual artists being feted by name. Patrons showed their taste by the artists they chose, and the topics they chose to have portrayed. But connoisseurship, appreciation of artistic value, was contested, and experts worked to establish credibility (thesis:172).

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265 Imperial College KG/2/17 *Reminiscences* 1961; Insley (2017),fn 34.
In Britain, art became more public, moving outwards from Church, Court and landed houses. The 2014 Tate Britain show, *Sculpture Victorious* (thesis:173), examined how this affected the role of sculpture; the massive catalogue gave in-depth discussion of each exhibit, naming the people involved in its creation, with selected bibliography and noting where it had previously been displayed (Droth et al, 2014).

Reasserting the value of individualised art and artisan skills, both the Arts and Crafts movement (members of which nonetheless made use of mechanical reproduction of their designs) and the Art Workers Guild organised public exhibitions to help make the point. In contrast, Benjamin, in *The Work of Art in the Age of Mechanical Reproduction*, maintained that creativity and genius (in art) were outmoded concepts. Art had always been reproducible, with replicas used by pupils practising skills, for diffusing work, or in pursuit of gain, for instance through printmaking. An original artwork carried an aura built up from its experiences since completion which would be missing from reproduced copies; Benjamin suggested as a result that mechanical reproduction required a new form of visual perception. Copies could be exposed to audiences where the original could not go, but became detached from tradition as a result. For Benjamin, the aura had its value based in ritual, and once authenticity was no longer guaranteed by artistic production, art was not based on ritual, but on politics. The two poles of value were cult and exhibition. The first arose from the fact of the artwork’s existence, even if not seen. The second permitted simultaneous collective experience by multiple audiences in an unmediated manner (Benjamin, 1935/2008).

All the models were intended for exhibition of a sort, with education in mind. Crystal models could be handled either in supervised classes or individually at home, but their shapes were standard, and stood for unattainable specimens. The author (of the model) was irrelevant, but the model had to be accurate. The original might well be an actual specimen, but not necessarily present, the model carrying the original’s meaning (an immutable mobile in ANT terms) but not its aura.

Acknowledgement was extremely problematic. The architectural models helped resolve structural debate, occasionally through public (and therefore less mediated) display. Authorship was usually attributed to the architect rather than the maker. The original in most cases was the already-constructed building, models being used to elucidate parts of its structure, deduced from observation, measurement and drawings, both archival and contemporary. Arguably, they acquire auras of their own, as a result of handling and storage, active interference being kept to a minimum (interventive conservation only taking place when absolutely essential). The dioramas gave impact to public displays,
losing context when removed from those exhibitions. Roussel fought for authorship to be formally acknowledged; the makers could and did sign their work, sometimes in inconspicuous places. Careful display and handling was the norm, and generally makers were recorded if not remembered. If dioramas needed repair, the people who carried this out were not always credited (Wembley in 1924 (thesis:103-104); Paris in 1937 (thesis:121)); Roussel contested who should (thesis:112), and was photographed retouching *Medieval Ploughing* (thesis:114, plate 18). A counter-example would be the museum’s description of the replica Dalton lecture diagrams, where content and context was more important than the fact they were copies (thesis:179).

**Attitudes to people**

Here I comment on attitudes shown to the makers of models (a major concern of this thesis), to the audiences for which models were prepared, and to the contribution by a handful of women to the creation of specific models within these collections. Determining the value placed on these under-appreciated people required consideration of meagre documentation in many cases, or deduction of attitudes of owners and custodians from the absence of archival evidence.

A visible increase in institutional homage to makers is evident in several major recent exhibitions, such as the Tate show *Sculpture Victorious* discussed above. The Royal Academy installed Joseph Cornell’s diorama-like shadow boxes in *Wanderlust*, (2015). From the 1930s to the 1960s, Cornell created imaginative constructions from assemblies of ephemeral material, and was acclaimed as an ‘incomparable artist’, with an independent creative voice. The British Museum’s *Rodin and the Art of Ancient Greece* (2018), whilst celebrating Rodin’s work alongside Greek sculptures that had inspired him, showed and named his studio assistants, workshop carvers and the foundries that produced full-scale pieces. Rodin was mostly self-taught, learned drawing and painting from H L de Boisbaudran (thesis:32-33), and worked as a craftsman and ornamenter before setting up his own studio. The label for *Thought* (1895), a marble statue borrowed from Musée d’Orsay, Paris, noted that it had originally been called *Thought Emerging from Matter*,

perhaps referring to the ancient idea that artists had an inner vision of the subject of their art. They alone had the capacity to release this image from the unworked block of stone.\(^{266}\)

Giving Rodin’s assistants’ names acknowledged their collaboration; however, the exhibition title did not, emphasising as it did the individualisation of artistic genius.

\(^{266}\) Museum label (visit, 10 May 2018).
Crystal models were copies of idealised but naturally-occurring forms, produced by skilled technicians, whether artisans (defined by Williams as independent producers offering their own work for direct sale) (1981/1986:44), or directly employed (such as Beloeuf, with tied accommodation) (thesis:69). The makers followed prescribed patterns, the rules of crystallography, in artisanal situations, their creativity only lying in the application of manipulative skills. Architectural models were produced by trainee architects, studio assistants or carpenters – direct employees, copying an existing building in miniature (except for the rather earlier Great Model, created by others from drawings by the idea creator). A sense of ‘architect-as-artist’ lay in the nature of the decoration for which the model was a base. The architects themselves experienced professional insecurity during the period of this study (second half of the 19th century). Burges named the artists who decorated his models but not the makers (thesis:84). Alfred Stevens’ dome model was preserved under his name rather than that of his unnamed carpenter (thesis:86). Pall Mall Magazine argued for greater visibility for Cathedral models, naming artists but not the artisans (thesis:88-89). The 1930s dioramas were constructed for the Science Museum by trained and creative artists, but working in a commercial context; Bauhaus, rather than Beaux Arts (Morris, 2006). The makers saw themselves as artists, and painted or sketched with great facility (Roussel, Ivester Lloyd). Mostly, they did not originate the models themselves, two exceptions being Broun-Morison (chemical laboratory models) (thesis:160) and, again, Ivester Lloyd (rural industry scenes) (thesis:123-125). At the Imperial Institute, they were employed full-time; for the Science Museum, they were independent professional workers, albeit loosely grouped together around Roussel, producing work to commission, for sale (as defined by Williams, 1981/1986: 39-41). Williams characterised this as work ‘selected at so early a stage, on the basis of a few examples or of some calculated or projected demand, that production, from that stage, no longer originates with the primary producer but is commissioned from him [sic]’ (ibid.:105-106), such as the diorama series made by Ivester Lloyd for the then London Museum in 1930 (thesis:130). The subsequent treatment of the makers of all the models followed attitudes of the wider societies in which they lived; the present problematic is to establish how they might fit with today’s concerns and tomorrow’s futures.

Once found and patronised, what then for the makers? For crystal modelmakers, their identity was irrelevant when the models were handed over. The items were for handling, so not particularly precious; they were usually unsigned (although initials have been found on one or two, and some carry inconspicuous makers’ labels). Details have been gathered from accompanying print such as leaflets, box labels and textbooks. Here,
attitudes to manual trades and craftsmen are reflected by the absence of much
documentation (thesis:141). For directly-employed workmen, archives may be found
(Haüy, de l'Isle). For independent manufacturers, such as Krantz, archives may well
exist but be held privately (correspondence with Robert Jameson was given to the NHM
library by the Krantz family) (thesis:61-62). How the makers saw themselves was

For the architectural models at St Paul's the situation is similar, for the architects as well
as their assistants or cathedral carpenters who did the work. Architects had fluctuating
professional status issues, as they both commissioned high art, being remembered by
name through the models they arranged (Wren, Burges, Macartney, Stevens), and
mingled with manual tradespeople such as carpenters and joiners. Surveyors of the
Fabric are celebrated in the Crypt of the Cathedral beside well-known artists; for the
living, the situation could be rather different (thesis:93, for example). Within the
Cathedral, there was a strong sense of separation between clergy and secular staff,
with at times monumental disregard for the latter. Both Penrose and Allen were treated
badly, despite long service (thesis:76-77, 93-94); assistants, not being Cathedral
employees, were rarely named in official minutes. For example, finding Whellock's story
was extremely difficult. His name appears infrequently in official sources, although for
many years he was pupil and assistant to Penrose (thesis:79, 84-85). His unattributed
initials appear on some drawings in the Architectural Archive; his name is in the Chapter
minutes because of a horrific accident, detailed in personal papers lodged elsewhere.
He illustrated Penrose’s work and other Cathedral features for *The Builder*, signing
engravings but unmentioned in their captions, which were indexed by title but not
content. Finding information about individuals requires an awareness of the limits of
earlier documenters, recording what seemed reasonable to them at the time.

These limits can surprise. I first found Whellock's name in an unreferenced remark by
John Physick, a much-respected architectural historian. My identification of Whellock as
a model maker for the Cathedral required a return to sources as close to the original as
possible, in this case, lacking other archival evidence, the catalogue entry for the 1866
Summer Exhibition. This was despite well-intentioned but incorrect advice – in general,
the RA catalogues do have very brief entries, but just occasionally, as here, the entry
was both full and explicit; finding it corrected many years of invisibility (thesis:79-80,
plate 11). I remain intrigued that Physick identified Whellock as making other models
without giving attribution; it was as though he knew it to be true, but had forgotten how
he knew it. In comparison, journal illustrations but not the captions carried Whellock’s
name.
Another factor affecting attitudes to model makers may be the view taken of their intended audiences. Art historians are rarely artists, makers of crystal models are not necessarily crystallographers, and diorama makers are not historians of the scenes they depict. Audiences for crystal models were intended to be serious university students or interested autodidacts of any age (and indeed at any time, after publication of the relevant text). Architectural models had either a wow-factor to impress potential clients, or accurate detail to enable discussion about important points of structure or decoration. That they could be appreciated by less knowledgeable onlookers ready to pay for the privilege was initially secondary. Dioramas were definitively aimed to attract, inform, educate and entertain a general public. The attitude of commentators to publics of this nature – general, less educated or knowledgeable, even perhaps children – depended on whether this was thought to be acceptable or desirable. Ideas of customer care developed slowly. I recall the impact of Disney-style training for front-of-house staff in South Kensington museums in the late 1980s, coupled with income generation from attendance charges, and performance reviews establishing whether visitors enjoyed themselves. More recently, before the opening of the new suite of galleries at NMS, surveys suggested that visitors preferred free wi-fi to long explanatory labels – they can instantly pursue their own enquiries, beyond museum control, through searches on their mobile phones.267 The labels are short.

In different diorama forms having a separate history, taxidermy specimens played a significant part in presenting new ideas of biology and evolution in the great 19th century museums. As these institutions changed with time, so did their approaches to display (Rader and Cain, 2014) and the reception of these by increasingly attentive and critical audiences (Haraway, 1984-5). Both ethnographic and anthropological displays including modelled humans have a contested position in museum display, the portrayal frequently showing the portrayed as primitive or inferior. Gathercole and Lowenthal (1990) showed some redress for this, editing proceedings of a world congress attended not only by archaeologists, anthropologists and academics but also representatives from differing cultural backgrounds, invited as equals for their own expertise.

Few women emerge from the shadows in this story. Exceptions found so far for crystal history are Delvalle Lowry (engraver and author) (thesis:53-55), Margaret Reeks (university lecturer) (thesis:70) and Mrs G M Davies (wife and amanuensis to geologist and author husband) (thesis:65). For dioramas the stand-out people are Jane Jackson (diorama maker and medical illustrator) (thesis:121-122), Miss M Durrant (diorama

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267 Equinoctial Seminar visit and gallery tour, 13 Mar 2018.
maker, remaining deeply invisible), 268 Barbara Campbell (people modeller for the Shipping Gallery and children's author), 269 Pat Freeborn (partner to husband Derek, in a modelmaking business) (thesis:127), Charley Wood (diorama maker and head of studio) 270 and Jenny Clements (Science Museum design studio manager). 271 Within architectural modelling there are no women directly connected to the stories here, but they do appear infrequently in wider literature; Moon notes female architectural model makers as being 'almost invisible', in one paragraph of her chapter on makers (2005:147-148: 227, fn41). The accompanying footnote is more explicit, naming modelling mothers of more well-known makers, and four other women working in their own right. Jean Hetherington and Ethel Bartholomew both authored articles on modelling; the other two, Joyce Inall (thesis:99) and a 'Miss Swift' were named makers in articles written by others.

Rowbotham's *Hidden from History* remains a useful general survey of changing social valuation, class and economic issues for women in England from the Puritan revolution to the 1930s, first published in 1973, with further editions to 1992 (thesis:148). A feminist history of women artists by Rozsika Parker and Griselda Pollock reminds readers that there were indeed many women artists (1981); Artemisia Gentileschi's early 17th century self-portrait was exhibited at the Royal Academy exhibition *Charles 1 – King and Collector* (2018). Of the women artists mentioned in this thesis, Jane Jackson and Barbara Campbell both have substantial bodies of extant work, and are respected in other areas, Jackson as a medical illustrator, and Campbell as a children's author under the pen-name 'Cam'. 272 For the latter, there are copyright restrictions to her writings, which was another cause of invisibility. In architecture, women could be informed clients, such as Sarah Losh (Uglow, 2012), and more recently as architects in their own right, the late Zahah Hadid being the first woman awarded the RIBA's Royal Gold Medal in 2015. Moon featured Hadid's concept models, some being made by other model makers (2005:134, 171).

268 I have been unable to find even her address in trade directories, but she made five dioramas for the Mining Gallery at the Science Museum, in 1951 and 1952.
269 Barbara Campbell made the figures to be set in the various scenes in the Shipping Gallery and elsewhere.
270 Supplier to the medical galleries in the Science Museum in the 1980s.
272 Her children's books were produced between 1944 and the late 1950s.
The Research Questions

These were used to shape the various parts of the study:

- What factors affect the visibility of the models and their histories?
- What factors affect the visibility of the makers and their histories?
- What factors affect institutional processes of remembering and forgetting?

Factors affecting model visibility:

The primary factor affecting the visibility of models is whether or not they are on public display. My first task for all collections was to establish what models there were, through a combination of physical and archive searching. Crystal models were intended for intermittent handling, so were routinely stored and brought out; architectural models studied here were intended for short but intensive active lives; dioramas had long active lives in the exhibitions for which they were commissioned, but became burdensome off display. Survival in storage depends on intrinsic robustness, the sturdiness of construction materials and methods.

Some models carry signatures, particularly dioramas and architectural models made by external makers; crystal models are generally too small. Other historical evidence lies in marks left by handling, exhibition numbering schemes and labelling, or even in being suspiciously clean, individual auras indicting extent of use and degree of care and attention. This may or may not be obvious – as Marcus remarked, this kind of information is not necessarily shared openly with audiences.

Generally, models are separated from identifying documentation and reference originals. This can vary – some crystal models were stored alongside specimens, but unrecorded. I removed them to be stored and handled sympathetically together, but photographed and located. The architectural models are housed inside the referent building, documentation being dispersed. Diorama records are co-located at the same site, but in different buildings. Good collection care regimes preserve the integrity of the model collections against physical, chemical and biological environmental degradation, backed up by accessible records. All three institutions acknowledge the desirability of this, individual projects such as gallery clearances, collection reviews and so on being used to enhance digital information recording and retrieval, when staff are available, a management priority issue. Providing access, sometimes to awkward locations, and maintaining order in stored museum collections is a sector-wide concern.
Further or continued exhibition depends on perceived utility – crystal models can still be handled in the same way, architectural detail models can act as reference tools for aspects of the building. For dioramas after their primary exhibition closes, utility relies on finding alternative homes, or novel uses; while they remain materially sound, they are available.

**Factors affecting the visibility of makers:**

Some makers signed their work. Leaving a visible mark on the model even in an inconspicuous place ensures a connection between maker and future audiences, a notable example being the Science Museum’s *Roman Hospital* diorama, which carries multiple signatures on the front and user information on the back, only seen but unmissably when dismantled from show (Plate 30). Signatures might be obscured in display; Roussel particularly taking contractual steps to enhance makers’ acknowledgement.

Crystal model makers were mainly unnamed, but specific historical studies unearthed some details from institutional archives. The absence of makers’ names in the Cathedral records inspired a separate investigation of two centuries of London’s architectural modelling trade, giving wider context. ANT encouraged me to look for unmentioned makers; identifying Robert Whellock’s role was particularly satisfying.

Small business records rarely survive in archives; some evidence was cautiously deduced from trade directory entries, an independent source of otherwise unavailable information. Lacking direct evidence for how the makers were trained, I consulted general histories of education in art and manual training, another gratifying discovery being how widespread manual skills must have been, and the significance of self-help through other ANT actors – books, societies and journals.

An indication of visibility lay in size and duration of successful businesses. The longest-lived businesses showed a willingness to diversify, not least through attempting to adapt to changing attitudes and demands from their potential clients.

How are the makers regarded – craftspeople or artists? Opinion forms from a combination of what they have done, and what they were seen to be. What they did resulted in models, material evidence of their skills, and the continuing existence of which shows their owner institutions did value the models (acquiring them initially) and continue to do so (they have not yet disposed of them). However, value judgements can only be held internally if the objects are known, as it is not possible to judge something if
Plate 30

1. Diorama *Roman Hospital*, Science Museum, as displayed [ScM image]

2. with front glass removed, during gallery dismantling

Signatures:
3. Far left (obscured in display)  4. Bottom left  5. On the back
you are unaware it exists. Appropriate value judgements depend on the accuracy of what is known, and vary with time. External opinions too carry weight in discussion and arguments – Burges’s ideas for the redecoration of St Paul’s were shelved under circumstances of considerable publicity, but one of the models survives – and where opinions shift, it can be important to know how and why, in the spirit of openness that Marcus champions (thesis:37).

The urge to categorise noted by Nicholas Thomas (thesis:31) invites a label for what the makers were (craftsmen, technicians, mechanics, students, assistants, servants, artists in their own right). As art divided between art and craft at the beginning of the 19th century, a later further division arose for design, as commercially directed art. I remain in awe of the makers’ skills, and suggest that were these models to be made today, it would likely be by people labelled commercial artists, the models having utilitarian but cultural functions, and both economic value and the potential for ongoing emotive effects if this is facilitated by the owner institutions.

**Factors affecting processes of remembering and forgetting in the institutions:**

Institution history is incorporated in normal practices (official remembering) through passing mentions, occasional exhibitions or publications celebrating specific events. Disposal procedures formalise official forgetting; investigating them helped uncover what the institutions valued in their holdings. I believe on reflection and from this research there is a real danger that institutional memory is not embedded at all, can be lost remarkably quickly (as Connerton implied), and depends crucially on accessible records rather than individual knowledge.

The three institutions currently have a presumption of retention and care for their collections. Significance criteria were used in Science Museum gallery clearance projects before I retired. NMS saw a major shift towards photographs as artefacts in their own right rather than merely providing context to separated but linked material (thesis:201). With better known back stories, there is a much greater range of options for collection use, a greater polyvocality in the stories the institutions can tell. Memorability is not neutral, and memory is selective – during one conversation, the Cathedral conservator remembered Whellock’s name, but because of his accident rather than his modelmaking. Connerton’s diagnosis of the way society wrestles with increasing information and concern for archival retention of memory, alongside socio-political structures encouraging forgetting (thesis:204-207), was evident in audience reactions to my various presentations, a common remark being ‘I hadn’t thought of that’. Individual staff, acting in unexpressed but societally determined ways could render
model makers invisible through simply not considering them. This helped me to understand an approach to model preservation that cropped up during one conversation, which for ethical reasons must remain anonymous; if sponsorship could not be found to cover costs, perhaps the models were not as important as their custodians believed (thesis:206), ignoring the question of how one’s audience could judge the worth of an object when they know little about it, and clearly associating value with monetary worth.

At the Cathedral, for the surviving models, it is possible to identify when institutional forgetting might start, as their primary relevance ended. During discussions of decoration or structural support, the models were displayed only very briefly, but were then retained. Pressure to show them more widely came through the early 20th century, tending to revolve around the truly magnificent Great Model; other models were peripheral, and at times none were on public view. Not being directly connected with the main function of the Cathedral, their ongoing survival is more problematic than that of items in museum collections.

**The usefulness of the literature**

I have consulted diverse literatures during this study, ranging from introductory guides where I could find them to detailed archive sources for individual pieces of information. For clients commissioning models, I looked for intent, the wider context within which a model would make sense (teaching crystallography, repairing a cathedral, producing a technical exhibition), where the makers might be found to do the work, institutional approval where necessary, and to a lesser extent in this study, the model’s reception by its audiences. With the model as starting point, issues of identity and likeness required specialist literatures, for both textual and pictorial reasons; once the work was agreed, institutional records, documentation and archives might illuminate the making; policies, guides, publications and catalogues would show the audience offer. Context for matters affecting the on-going utility of the models came from wider studies of society, status and other interlinking dependencies, including memorability, the craft/art dichotomy and authenticity of copies.

Reviewing the literature in Chapter 1, I would cite the following as the strongest influences for me. Gardner encouraged the idea that my work on previously unstudied models as grassroots history, discovering unremembered stories concerning unremembered people, and trying to link them to the present. Modelmaking is a rather niche trade, but has far richer histories than I realised at the start. Invisibilities lie with Hobsbawm’s and Renan’s ideas of decontextualisation and lies – museum models are
almost always removed from their primary (or first) place of use, the cathedral models are not in active service. Marcus reinforced their take on lies in history, arguing for greater effort in explaining background information and decisions behind public exhibits; their take on omission underpins much of my search for absences from official records. Discussion of the non-human turn justified using Actor-Network Theory; Jordanova was less dogmatic, considering approaches rather than theories, and the use of multiple sources. Grusin’s survey foregrounded objects, Massumi and later Dudley emphasising constructivist learning from experience, and developing new cultural takes on things, important for potential future uses. Both Jordanova and Knell pointed out that objects have meanings because people give meaning to them; Brown quoted Stein’s remark that things are what we encounter, ideas what we project. The models are things, intended to project ideas. Castoriadis reminded me that objects mean different things in different contexts; Stewart’s perspectives on souvenirs and collections allow reconsideration of types of ordering and classifying; Thomas suggested categories based on judgement, with resulting narratives historically refigured, provoking for me the question of what future narratives might be.

For Chapter 2, the history of models, I found few general overview texts, apart from those by King and Moon. Specialist literature was key for finding identities and likenesses of crystal models; appealing stories revolved around Delvalle Lowry and the backwards trail for self-help paper models, about which I have published separately; the more contemporary historical work by Burke and Touret were immensely useful. For St Paul’s Cathedral, the histories by Keene (of the Cathedral) and Rome Innes (of the Great Model) stand out. Neither contained much about the other models; I relied on fleeting references in cathedral papers, journals of the day, and anecdotal scraps about Robert Whellock and Thomas Wilby leading to other archives elsewhere. For dioramas, the most recent work containing much of the background history is Szenieren und Illusion, which is mainly in German; my own major sources were Science Museum documentation and on-line newspapers (since complemented by archives from the National Archives at Kew, London).

For Chapter 3, the history of model makers, London directories gave a usefully independent overview of the trade, with stories for Thorpe, Wilby and Farmer and Brindley enhanced by archives elsewhere. Kaye’s study of the architectural profession was comprehensive and accessible. The self-help paper model story complemented this also, demonstrating the extent to which one should not ignore hobby modelling, as it forms a pool of haptic skill that is otherwise invisible. Recent works by Shiner and Mansfield on history of art, and the huge Tate Britain exhibition Sculpture Victorious
helped to show how collaborative figurative art could be; Adamson’s work on craft history helped me think that perhaps my strong support of the importance of manual skill was not entirely misplaced. I have struggled with the modernist view of copying in art. As copying was essential in acquiring and demonstrating skill, I have been bemused by the idea of art defined by expressive freedom denoted by its absence of skill, and how this idea permeated the management of art collections in major institutions. Even in post-modern times, the almost mocking tone of Jenkins’ review of the Cast Courts at the V&A, declaring their contents as fake, holds echoes of Benjamin’s ‘aura’, denying the value of the copies that would have been applied to the originals. Considering aesthetic values, authenticity becomes a judgement call. Knowing and saying which is the original addresses Marcus’s point that truth is fragmentary and incomplete. For nationally important institutions, being honest about decisions, choices, activities and results is vital to inspire and retain the trust of audiences. The Science Museum’s own guides showed how this was neglected in the past.

Works by Linde and Connerton were fundamental sources for me for aspects of institutional memory and forgetting, with the still relevant NMDC publication Too Much Stuff offering a national take on disposal policies for Britain’s museum sector.

**The usefulness of ANT**

Privileging objects came naturally to me, as a former museum curator. When faced with unidentified, context-free objects, I searched for histories starting from the object itself. The constructivist approach noted by Massumi (thesis:29) and used by Dudley (thesis:36) as applied to museum objects involves using one’s senses – sight, touch, hearing, (not usually taste, but sometimes smell) – to build understanding of what the object is. Using ANT invited me to extend this, to consider how the object came to be what it is. This also is familiar from my museum practice, attempting to find aspects I would otherwise have missed, finding the missing parts in incomplete stories. Unexpected discoveries included the context surrounding self-help crystallography study, names for makers of seminal models used in Cathedral developments, world exhibition quality models of cathedrals in cardboard made by a rent collector, Wilby (thesis:145-146), and a hairdresser, Sling (thesis:157), and the sheer scale of the use of dioramas from the 1930s onwards.

Given the ANT premise of concentrating on what objects do rather than what they mean, (thesis:29, 31), it was ironic to discover the Science Museum’s Childrens’ Gallery Guidebook inviting the opposite, in the 1930s. Potentially, the issue here is that primary investigation involves discovering what a thing is and how it works before discovering its
significance. Jordanova denied objects agency; Knell denied them speech (thesis:30). I would suggest that although these objects do not intrinsically have intent, they do embody the intent of their commissioners and makers; and what these objects were intended to do was to present in 3D materiality one person’s ideas to another. The excited gasps emitted by both myself and my volunteer Valerie on pulling open a drawer to find mixed-up hundreds of Werner-style crystal models were expressions of how we felt, not the objects – to declare the objects exert force is one way of describing this. For this to happen, the models had to be in a particular place, to which Valerie and I had to be admitted – passing through an obligatory point of passage (the entrance to the store). This required a combination of factors – permission and assistance from internal staff to give us access, the models to be there, for us to have made the journey to see them, resulting in our being affected by the encounter, so an ANT translation had taken place. Permissions depended on institutional policy and procedures; the models would not have been there without having been made in the first place, implying the desire for models to be made, and the availability of makers able to make them.

Foregrounding objects and their documentation, ANT provoked consideration of subsidiary characters such as publishers and illustrators in producing, using and marketing models, and invited independent and on-going consideration of what meanings the objects carried in their active lives compared to those that curators might wish to illustrate, in exhibitions or other aspects of modelling within history of pedagogy. Arising from the varied literatures of aspects of my research interest, ANT served as a pre-inspection justification for what I was going to do, coupled with post-inspection (and on-going) reflection for potential new insights.

**Inadvertent activism**

I began as an enthusiastic, semi-knowledgeable enquirer, but became an inadvertent activist. During my work, I noticed changes in attitude towards the models on the part of their custodians, albeit not in the embedded, cyclical manner of formal action research. In parallel, I searched institutional records and archives, following hints from related literature, trade directories and elsewhere. My interaction with institutional staff has been largely positive, access being provided as fully as institutional priorities could allow; I have routinely agreed to share discoveries, and been encouraged to take the stories of the models and their makers to wider audiences. Most recently, I have spoken on Delvalle Lowry’s crystallographic illustration to historians of geology (Insley, 2018). In the history of education, I was delighted to discover and re-publicise such snippets as the date of introduction of block toys to children, in the writings of the 18th and 19th
century educational luminaries Maria Edgeworth and her family. Better understanding may inform future activities.

Nothing has an automatic right of survival, but where pieces remain of a larger body of work, newly-rediscovered stories enhance their present utility. That the diorama artists worked together in studios both in a neighbouring institution, and independently to meet demand, was officially unacknowledged, although must have been obvious at the time. The Imperial Institute studio features in the current history of the Design Museum in Kensington, with an incorrect caption (Wilson, 2016:55). Roussel’s influence on South Kensington displays was huge from the 1930s to the 2010s. I found rich stories behind the dioramas and their creators, and continue to publicise them.

For the crystal models, my previous experience helped me gain permission to work with them, bringing considerable order to a little-known collection. My first related publication was a research note for the Institute of Education’s e-Journal, considering visual ideas from crystallography applied to history of kindergarten pedagogy, bringing crystal models to the attention of historians of education (Insley, 2015a). An unpublished study of J J Griffin’s career gave insight to one model set at NMS, provoking a survey of late 18th and early 19th century crystallographic literature. My study of a set of card crystal models illuminated part of the crystal model-making trade, connecting it to the wider pedagogy of children’s informal training in model-making (Insley, 2017).

At various times, staff have borrowed crystal models for lecturing (as was their purpose), but failed to note details, or re-shelve them accurately. Through my interest, the crystal models’ condition was checked by conservators, and relocated, sorted, in the new store. I was partially supported by a grant from the international Scientific Instrument Society, publishing a summary in their Bulletin (Insley, 2015b). Consequently, there has been interest (and visits) from other international researchers. The collection is more easily accessible; the museum has copies of my work for their records. Both stores and curatorial staff are alert to work still outstanding, adding further information or more stored models if they are found. Some models are displayed in the Science galleries opened in July 2016.

I have contributed to questions of current concern in various ways. My results are available for collections review at St Paul’s Cathedral, and informed a recent AHRC-

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273 Edgeworth (1801) p.38: ‘We have found that two or three hundred bricks formed in plaster of Paris on a scale of a quarter of an inch to an inch, with a few lintels etc in proportion, have been a lasting and useful fund of amusement’. Not mentioned in first edition of 1798.

funded research project to maximise potential use of stored collections in the Science Museum Group (SMG).

Research such as mine helps institutions to understand their own value judgements; one notable outcome of *Energy in Store* was that the Group Head of Collections Services, responsible amongst other things for documentation, admitted having a much clearer appreciation of why making documentation available for researchers was so important. From the institutions’ point of view, in-depth researchers are mixed blessings, possibly requiring intensive assistance but bringing rich new insights. To maintain institutional memory, these should be recorded for the future, or they will disappear again.

At the Science Museum, collections review precedes the move of a very large store. Again, I was consulted about collections formerly in my charge, despite retiring over five years ago. The collections have been moved since, so my memory of where things were was out of date. Perhaps more disconcertingly, I discovered that knowledge of the story of Torricelli’s barometer experiments did not necessarily include an understanding of how mercury barometers work, or how this would be reflected in what one looked like (the presence of a glass tube longer than one metre in length being essential). Without personal knowledge, records are paramount. But institutional memory can only be tapped into if records are consulted. Knowing that one should, and how to do it, requires training from senior or more experienced staff. Memory practices were demonstrably not built in – accurate, precise institutional memory disappeared within five years.

I have delivered talks on institutional forgetting to a mainly literary audience in Northern Ireland, to curators of science and technology at the CIMUSET meeting in Milan, and about the architectural collections of St Paul’s Cathedral at international meetings of historians of science in Turin in 2015, architectural historians in Delft in November 2017, and to heritage-minded structural engineers in London in 2015. I gave a public lecture for the Cathedral’s Collections Department in April 2014. I did not anticipate when I started that I would have this degree of impact, although the more I

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276 Visit, 21 September 2017.
282 *Saving St Paul’s in the 1920s*, April 2014.
discovered about the makers and their work the more I was determined that their contributions should be better known. To an extent, I have succeeded.

**Invisibility elsewhere?**

Once the models had fulfilled their intended purpose and were no longer essential, their visibility became problematic. Given my interest in the nature of the visibility or otherwise of both makers and models, it is worth considering whether these concerns arose in the other disciplines to which the collections are linked – crystal models with science, architectural models with architecture and art history, dioramas with events and processes in industrial and social history, and all three drawing upon and contributing to histories of both education and the art and craft of representation. All these disciplines have their own preoccupations, concerns and institutions; with a few exceptions, model making was not a major interest.

In the history of science, de Chadavrevian and Hopwood’s *Models* (2004) contained sections on modelling and the Enlightenment, disciplines and display, methods used in construction of models and links to material culture. Discussing 18th century models, Malcolm Baker commented on the failure of both history of science and history of art and visual culture to give 3D models their due. ‘If historians of science marginalized visual representations in favour of texts, historians of art and design tended to privilege the 2D in the form of the drawing, over the 3D, in the form of the model’ (De Chadarevian and Hopwood, 2004:19). Baker argued that using models in natural philosophy was not a discrete phenomenon, and used two models of transport vehicles (a wagon and the Royal Coach) to compare and contrast a model for public demonstration with one intended as a luxury item. Despite their many commonalities, the two models had not until then ever been discussed together, despite both being in prestigious collections and well known (ibid.:20-23). But they were invisible to each other, and between the two fields of interest to which they had culturally been assigned.

Christoph Meinel's chapter dealt with molecular rather than crystal models; I have argued elsewhere that his view of the likely influence of Froebel’s construction kits misses the possibility that Froebel had himself been influenced in their making through working with the crystallography collection of Christian Samuel Weiss in 1820s Berlin (Insley, 2015a). More recently, interest re-emerged in 2017, the Centre for Visual Arts and Culture at Durham University hosting a conference, *Molecules and Models*, on visual thinking behind the structure of matter.
There is current interest in institutional forgetting of other kinds. The Scientific Instrument Society’s annual Gerard Turner Memorial lecture in November 2018 was delivered by Simon Schaffer, Professor of History of Science, University of Cambridge. He examined the attitudes of the officers of the East India Company to their Indian assistants and servants, uncovering a hugely racist denial of their potential abilities to understand or practice science. Dr Sita Reddy, an independent researcher, for her forthcoming paper ‘Refiguring the Indian Botanical Archive’ in the Wellcome Collection’s Exploring Research series, suggests that archival remembering, in the case of colonial archives, goes hand in hand with archival forgetting. She too used East India Company-era records, in this case medico-botanical archives with multi-genre collections (art, herbaria, manuscripts) dispersed across libraries, and artists or makers unacknowledged in favour of their corporate commissioners and surgeon-botanists.283

Architectural history is fairly recent, emerging in the 1960s, but classical references and styles had long been used in architecture — an iconic overview by the two Bannister Fletchers, father and son, was first published in 1896. Guidance about the history of architecture within history as a discipline was facilitated by Kaye’s study of the development of architecture as a profession (1960), and a summary of architectural history methodology published in Architectural Design (Porphyrios ed), 1981.

Architectural models do survive, and are occasionally displayed. The Great Exhibition (1851) included architectural models under Sculpture and the Plastic Arts, with 56 entries being models of over 70 buildings or monuments (Anon., 1851: 828-843), where I began my investigation of the architectural modelling trade in London. In the UK, twentieth century exhibitions were infrequent, several claiming to be the first (Moon, 2005: 18-19). A monumental international touring exhibition Italian Renaissance Architecture: Brunelleschi, Sangallo, Michelangelo & the Cathedrals of Florence and Pavia, and St. Peter’s, Rome (1994) exhibited some of the most important surviving Renaissance models, and was followed by others in the later 1990s (Millon, 1994 and 1999). Well-made models of prestige buildings or by/prestige architects have a better chance of survival and on-going visibility with owner, architect or client.

Architectural models accumulated at the V&A have a checkered history (Leslie, 2004) (thesis: 212). Other notable London collections of models include those of the RIBA, and Sir John Soane’s Museum in Lincoln’s Inn Fields. Viewing these last requires prior booking and luck, as tours of Soane’s Model Room only run when there are curators

283 20 November 2018; through Mersenne Bulletin Board.
available and may be cancelled at short notice, yet another form of invisibility. Internationally, models that are unusually old, or spectacular in some other way, have active lives lasting over a range of timescales. Where their original function is appreciated (such as the Great Model), their value is high, and increases where new uses can be found for them. However, hobby models, created by amateurs in their own time, after the represented building is complete, do not attract the same interest without further relevant context, such as being made by members of St Paul’s Watch during the Second World War.

The institutions of art history were investigated by Elizabeth Mansfield (2002), focusing on sites of practice, how canons were established (what was included, or not) and how discourse disseminated practice. Comparing these aspects with respect to the models under consideration offers intrinsic factors contributing to model and maker invisibility. Considering sites of manufacture, the crystal model commissioners worked in universities, established places of learning with libraries, teaching facilities and workshops where employed technicians could be directly supervised, close to the specimens that were their exemplars. Visibility remained with the professor, scholar or patron, not employed servants or handymen. Mechanics might work at home with hand or small machine tools, bringing finished pieces to the institution (Adamson, 2013). The architectural models for St Paul’s were made on demand, either on site or brought in for reference. The 1920s structural models were made elsewhere. Where Whellock worked is unclear, but the models were fragile so it must have been nearby. The Science Museum’s diorama artists of the 1930s worked at home and in studios, but when the Imperial Institute offered in-house facilities for what must have been close to mass-production, the group accepted them. Their studio was photographed, and publicised by the director, but recording their names was left to a journalist (thesis:106).

The site of maximum visibility was where the models were presented to audiences rather than where they were made or kept, with mixed results. The St Paul’s models moved around the building, with occasional periods spent in publicly accessible areas such as the Trophy Room (for a fee) or the crypt spaces in the basement (for free). Crystal models were small, stored en masse out of sight, and produced selectively for demonstration. A prestigious later display of venerated historical models was erected at the Technische Universität Bergakademie, Freiberg, individually mounted in a dedicated room (‘Long Road’, 2017). Dioramas would be made for (or assembled in) their exhibition spaces. More flexibly, some were enclosed in cabinets with integral lighting.

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284 Attempted visit, 24 May 2018.
285 SPC 597.
and dust-proofing, allowing safe repositioning. Commissioners selected the model’s subject, albeit leaving some artistic interpretation to the makers, and where to exhibit. For habitat dioramas (the American Museum of Natural History Hall of North American Birds, opened in 1902) (Quinn, 2006:16) and war memorial dioramas (the Australian War Memorial’s initial planning began in 1918, and dioramas displayed from 1922) (Back and Webster, 2008:29), entire buildings were erected specifically to house the scenes and their stories. To visitors, these were grand and imposing; their contents were therefore important (although just how might not be particularly clear), visiting became a matter of ritual, homage and expectation, and audiences for public art were enthusiastic. The sites of exhibition enhanced the dioramas’ visibility, but over time, keeping the show fresh and interesting was problematic. The Rowland Ward gallery at the Natural History Museum, London, is now dismantled; *Agricultural Engineering*, the last gallery at the Science Museum with dioramas in display, closed in 2017. The galleries had become insufficiently relevant to retain.

The practice of modelling intermittently appears within art teaching. A professorship of modelling was established in 1850s London as part of Henry Cole’s development of national design. John Hancock taught sculpture modelling at the Central School of Practical Arts in London from 1854 to 1859 (‘Mapping Sculpture’, 2011). Discourse about architectural modelling relied on instructional manuals, pitched to amateur audiences, with few for professionals – Richardson in 1859, claimed to be the first to produce an instruction book for architects (thesis:157). Visual references to crystal models rely on published texts, which rarely mention actual making. The role of publishers as supporters of crystallography emerged for me through using actor-network theory (Insley, 2017). St Paul’s Cathedral Architectural Archive contains thousands of drawings and papers relating to the architectural history of St Paul’s, but little about who produced them, or how. Structural issues might require further sets of measurements to compare with those already in the Archive (Insley, 2016a), or to make a new model (possibly the cause of Whellock’s accident) (thesis:85). Gordon Whatman (1959) discussed Roussel’s methods of diorama making, and both Quinn (2006) and Back and Webster (2008) featured the process in their publications.

Science Museum dioramas straddle industrial and social history. Making miniature models, whether for children or for kings, goes back to pre-history (Cook, 2013). Individual types of models have their own histories, either of technologies (model railways, cars, aeroplanes, etc) (Williams, S, 2001), miniature representations of the adult world (dolls houses (Weingartner, 1983; Hatton Boyer and Weingartner, 2009), toy theatres (Speaight,1946; Baldwin, 1992), toy soldiers (Garrett,1959; Hofschröer, 2004))
or as part of public spectacle (Altick, 1978). It is quite unusual for these to overlap, perhaps resulting from fixed classification systems amongst practitioners and their historians, but there are increasingly pluralist approaches to research (I return to this in the next section). For a (so far, rare) wider view of model making generally, my initial guide was again King (1996), including architectural modelling, nativity scenes, railway layouts, ship models, kits and collecting, and a chapter on explaining structures.

Visibility regained – present-day relevance

With the speed and reach of today’s communications and social media, and not least because of the disconcerting rise of ‘fake news’, culture has never been more pluralist, or more divisive. The UK museum sector is placing huge emphasis on engagement, inclusion and community relevance in the face of serious concerns for future funding. In April 2018, the International Commission of Museums (ICOM) warned of a rising risk of political interference in museums and culture by nationalist governments, a warning repeated on the Museums Association website (‘Museums Association’, n.d.), real attempts to influence the kinds of institutional memory and forgetting that they would prefer, and a modern example of the situation remarked on by Hobsbawm concerning identity culture and the use of myth (thesis: 27-28). ICOM declared that museums should maintain control of the content and integrity of their programmes, exhibitions and activities. The collections in this study were already in danger of being forgotten or rendered invisible; my work has contributed to redressing inaccuracies in and supporting the integrity of official records. Retrieving history from below reminds us that history is more complex, more nuanced, than is seen by sole consideration of the star artists alone. I have been able to do this at a time when the possibility of chasing down information and detail is in danger of disappearing.

Despite their large scale disappearance from exhibition, there is growing academic interest in dioramas of all kinds, such as that in recent publications by Dr Sue Dale Tunnicliffe and Professor Annette Scheersoi (2015; 2018), demonstrating continuing potential pedagogic value. In the Australian War Memorial, Canberra (Back and Webster, 2008), the dioramas are memorials, and recently refurbished. Dioramas showing Aboriginal contributions to Australian war efforts had been removed from display, and although not discarded, they had not been stored with any care. A 2016 project saw the dioramas remodeled, to redress this significant absence,²⁸⁶ the kind of curatorial obscuration discussed by Marcus (thesis: 37). The Thorne Rooms of the Art

²⁸⁶ https://www.awm.gov.au/wartime/76; my thanks go to Professor Pam Meecham for bringing this to my attention.
Institute of Chicago, 68 miniature scale room settings displayed from the early 1930s, are still on show with regularly republished catalogues (Weingartner, 1983; Hatton Boyer and Weingartner, 2009). Between 1976 and 2012, the photographer Hiroshi Sugimoto (2019) posed people within the dioramas at the Hall of African Mammals, New York; since then, films in the Night at the Museum sequence used up-to-date special effects to bring the dioramas to life. A travelling show, Dioramas (2017), was staged at Palais de Tokyo, Paris, moving on to the Schirn Kunsthalle, Frankfurt, featuring examples of artist interventions. For the 600th anniversary of the battle of Agincourt, a new battlefield model was commissioned and displayed in the Tower of London, with low viewing points, windows and mirrors so visitors of all heights could see. How it was made was described on the Royal Armouries website, but has since been removed.287

Celebration of craft skill is becoming more widespread outside academia. On a historical note, both Gibbons (1648-1721) and Chippendale (1718-1779) achieved fame in their lifetimes, starting from humble beginnings, reaching peaks of fashionability and developing large workshops employing many other people. Both saw their styles go out of fashion before they died, having lost valuable support from aristocratic patrons who failed to pay either on time (Chippendale) or the proper viable rate for the job (Gibbons). Both men were commemorated by statues on the early 20th century façade of the V&A Museum, London, in post-mortem appreciation of their skills and artistry. Over a century later, both featured in Carved with Love: the Genius of British Woodwork (2018), a recent (and since repeated) BBC television series. Resurgence in media interest in craft skills in early 2018 saw a series of introductory events at London’s Barbican Centre encouraging people to take up craft, and a Crafts Council-supported series Make! Craft Britain on BBC 4 (removed from the BBC website by May 2019).

All three collection types have even been represented in clothing. A shoe with a skewed crystal model as its heel was advertised in March 2018;288 the 1977 Silver Jubilee Cope at St Paul’s cathedral features embroidered outlines of the 73 churches in the diocese,289 and ‘Diorama’ is a brand name for a Dior handbag.290


289 SPC 4018.
Frenchwoman living in the USA, and the book featured 30 stories of feisty women who had in some way or another, against all odds, managed huge achievements, such as the first black woman in space, and the winner of the 2011 Nobel Peace Prize. Cooke’s favourite was Frances Gressell Lee, devoted to the development of forensic science in the 1920s, and creator of dioramas as teaching aids for detectives, *The Nutshell Studies of Unexplained Death*. These are still in use, and were beautifully catalogued (Botz, 2004) (thesis:132). One featured in the Wellcome Collection’s *Forensics* exhibition (2015), and both book and models inspired a character in a 2016 crime novel (Deaver, 2016). Mrs Lee was also noted as the prototype for Jessica Fletcher, heroine of the long-running television series *Murder She Wrote* (2019). So here is outsider illustration, in an outsider book form, championing outsider women, and featuring an outsider art form with growing purpose today.

So what does the future hold for the models in these collections? In the short term the Science Museum will reduce its holdings of dioramas, which tell specific stories that may be difficult to re-purpose in today’s displays, may deteriorate if storage is substandard, but may be transferred to other more appropriate venues. Knowing which artist made which diorama allows this aspect of their work to be better known and appreciated by art historians more familiar with their other art – painting, sculpture, portraiture, posters, book illustration and publishing. Uncovering crystal model histories increased their cultural capital for National Museums Scotland. That collection has been studied more intently than any other in the country, and may serve as reference for curators of other crystal model collections as these come to light. St Paul’s Cathedral owns one of the most significant collections of architectural models in Britain, but almost unknown, unseen, and with very fragmented histories before now. Should the Cathedral decide to dispose, other London institutions might offer appropriate homes where the models could be more publicly appreciated.

What of the makers? Having the opportunity to study their under-represented lives and disregarded work has been both a privilege and hugely enjoyable, and I shall continue to seek out their histories and champion their causes. I am in awe of their skills and achievements, and grateful that their models came to my attention before disappearing from public awareness. For all three collections, my public reach has been international in scope and multi-disciplinary in theme. Fruitful opportunities for continuing study lie with questions of perception, visualisation, manual skill, education in history of science, art and pedagogy. Whatever the future holds for the models in these collections will be better informed as a result.
And both models and makers will be no longer marginalised victims of inadequate histories, but better remembered by their audiences, better understood by their owner institutions, and more available for pluralistic futures we cannot yet imagine.
Appendix: Architectural model makers in Directories.


Note 2 – Multiple-surname partnerships: Battiscombe and Harris, Bernasconi and Riddell, Bowden and Dorrell, Bull and Esdaile Ltd, Butcher and Axtell, Casentini and Wilson, Eichardt and Heyner, Farmer and Brindley, Fernnee and Fidley, Hudson and Braaen, Partridge and Horton, Shepherd, Epstein and Hunter Ltd, Thomas and Frediani

Note 3 – Partnerships with sons: Aumonier’s entry added a son in 1910, Seale in 1913; Boekbinder added more than one son in 1913, Elmes had his son with him from the start in 1891, and Plows’ son took over the business when his father died. There were two Barritts, Sam and James Littler, both working at 5 Fashion St, Spitalfields, in 1844, although the relation between them is not clear. Francis James Curley followed directly on from Michael Curley at 49 Flood Street, Chelsea, in 1897.

Note 4 – Addresses implying the types of premises: Ashenden/ Chenil Studio, Bees/ Units 2 and 3 , 44-46 Terrace Road, Casentini and Wilson/24 Hercules Buildings, Chipperfield/ Ham Yard, Gt Windmill St, Cunningham/ Unit 10, Utopia Village, DBP Models/ Lee International Studios, Dawson/ Guardship Studio, Church St, Easton John/ Hanway St Works, Farmer and Brindley/Hercules Bldgs, KB/ Camden Lock, Longbottom/ Northcroft Studio, McCutcheon/ both addresses, Reid/Chitty St Works, Shuttleworth and Unit 22/Unit 22 Wren St Works, Tetra/Studio A Covent |Garden, Tett/ Hanway St Works, Thomas and Frediani/ Wharf address, Thomas Glen Studios, Thurloe Models Group/ The Studio, Munster Rd, Wright/ Crown Works

Note 5 – Businesses with adjacent properties: Architectural Models, Baird, Bartlett, Bees, Braun and Co, CB, KB, Kandor, Marshall, Parallax Models, Partridge and Horton, Pipers Model Makers Ltd, Presentation Unit, Shepherd Epstein and Hunter Ltd

Note 6 – Businesses with simultaneous but separated premises: Ashenden, Bruciani, Bull and Esdaile Ltd, Casentini and Wilson, Chipperfield, Elmes, Farmer and Brindley, the Herberts, the Jacksons, the Mabeys, Massoni, Parsons, Partridges Models Ltd, Plastic Decoration and Papier Mache Co, Smart, Tett, Tunstall, West

Note 7 – Business lifetimes : 40 one year; 20 two years; 13 three years; 20 four years; 9 five years; 8 six years; 4 seven years; 7 eight years; 2 nine years; 4 ten years; 4 eleven years; 8 twelve years ; 4 thirteen years; 2 fourteen years; 3 fifteen years; 4 sixteen years; 3 seventeen years; 1 eighteen years; 2 nineteen years, 1 twenty years; 24 more
than 20 years – 14 between 21 and 30 years; 2, 31 to 40 years; 3, 41 to 50 years and 5,
over half a century

Note 8 – Firms including the same surname - Bing Brothers was an extremely important
German company of toy manufacturers, with a City address in 1902. G and A Brown set
up a limited company in Hammersmith in 1924, and J and H Patteson worked together
near Bedford Square in 1907 and 1908. Herbert and George Fernee joined up with John
Fidler in Camden Town in 1914, the Hannaford Brothers in London WC in 1927. James
and Charles Mabey had a complicated business history together from 1860 to 1917.
William Mossman’s pierced paper manufactory was taken on by his wife under her own
name in 1867.

Note 9 -- Examples of take-overs – Richard Chipperfield’s business, having moved
around a number of addresses from 1885, was taken over in 1904 by George Higginson
and Co Ltd at 5 Green Terrace, Rosebery Avenue. But William Salter also worked at
that address from 1904, with the remark in his 1905 entry that he had had ‘several years
with the firm of R Chipperfield’. One of the additional entries connected with Jackson
shows a partnership between Jackson and Braaen in 1932 at 46-54 Great Titchfield St
but not as architectural specialists, possibly indicating diversification. Cockade Ltd,
architectural model makers operated out of 35 Thurloe Place, South Kensington, from
1947 to 1953, and three years later in 1956 the premises were taken on by Thurloe
Models (M Sewell).

Grt Exh: Great Exhibition of 1851, with description of entry from catalogue
MMA: Model Maker Architectural
MM: Model Maker
1991(+?): entry in final printed copy of Directory; not necessarily the last year of business.
[Thompson]: Thompson Directories of London – rivals to Kelly’s/POLD
[Robson’s]: Robson’s Directory.
[Kelly’s]: alternative name for the Post Office London Directory (POLD)
[Pigot’s]: Pigot’s Directory
[POLD]: Post Office London Directory
Mapping Sculpture: the maker was featured in the Mapping Sculpture website; indication of
how much more information may be found is given in the entry.

Aeronautical and General Modelmakers Ltd
1971-1972 architectural, Hospital Road, Hounslow, Middlesex; thence, as general until 1975.

All Models (Industrial) (MMA)
1976 under Model maker only (continued).

Alpha Models
1988-1991(+?) 60 Eve Road, E15 3DH.
Architectural and Industrial Models Co

Architectural Models Ltd
1988-1991 (+?) 275-281 King St, W6 9LC.

Annan, James
1913-1914 37 St Barnabas St, Plimlico, SW.

Mapping Sculpture – In Edinburgh directories between 1860 and 1910 – may not be the same person.

Ashenden, Edward James
1952 7 & 15 Chenil Studio, 183 Kings Road, SW3 (MM-A; dioramas, models and displays).

Ashton, William
[1851 Grt Exh: producer, 154 Sloane St, Chelsea; p830, entry 152 - Lincoln Parish Church in Bristol cardboard].

Aumonier, Wm
1900-1909 1 New Inn Yard, Tott Ct Rd, W.
1910 becomes Aumonier, Wm & Son.
1910-1912 same address.

Mapping Sculpture: 1879 to 1930, with various descriptors architectural sculptor, wood carver, carver, gilder.

Baird, J & Co
1914-1915 110 and 112 Disraeli Road, Putney.

Bardwell, William
1843-1848 architect, 4 Grt Queen’s St, Westminster, except 1847, when his address is 11 Park St Westminster.
[1851 Grt Exh: designer, 4 Grt Queen’s St, Westminster; p831 entry 175 model for St George’s Hall; church; labourers’ cottages; improvement of Westminster church; stagecoach].
1852, 1854 architect, same address.

Barritt, James Littler
1843-1848 cabinet maker, 5 Fashion St, Spitalfields. (In 1846 described as Looking glass frame maker).
[1851 Grt Exh: designer and manufacturer, 173 Fleet St London; p842, entry 339 - model of picture – The Water Mill, summer evening].
1852, 1854 cabinet maker, 5 Fashion St, Spitalfields.

Barritt, Sam
**Bartlett, George**

1839 [Robson's]- Modeller.
1840 62 Wellington St, Goswell Rd. marked as architectural.
1842 61 Poland St, Oxford St.
1844 [Thompson] – same address.
1854 12 South Row, New Road.
1855 11 and 12 South Row.
1858 Architectural modeler, 45 Euston Road.
1860 ... not marked as architectural specialist, but the mark is replaced in 1862.
1869-1882 16 Dukes Road, Euston Road, WC.
1883 51 Euston Road, thereafter no longer listed as architectural model maker.
*Mapping Sculpture:* in directories for 1851 and 1860.

**Bass, Joseph**

1842 7 Little Abingdon St.
*Mapping Sculpture:* in Kelly's Directory 1851 as an architectural modeller at 26 ½ Royal Street, Lambeth.

**Battiscombe and Harris Ltd**

1927-1931 (decorators) listed under modellers. 41 Low, Kennington, SE11. In 1927 and 1928 share address with Boekbinder Ltd, modeller.

**Bees**

1988-1991(+) Units 2 and 3, 44 – 46 Terrace Road, Walton-on-Thames, KT12 2SD.

**Bernasconi, Francis**

1838 [Robson’s] – Plasterer; [Kelly’s] Plasterer to her Majesty, 19 Alfred Place, Bedford Sq.
1839 [Kelly’s] Plasterer, with Frederick, trunk maker.
*Mapping Sculpture:* entry features information about George Vincent Bernasconi, a relative; Francis was described as a highly successful stuccoist and architectural modeler.

**Bernasconi and Riddell**

1842 21 Dean St, Soho.
1844 [Thompson] 27 Francis St, Tott Ct Rd. Marked as architectural.
*Mapping Sculpture:* listed as a trading name, with entries from POLD in 1851, information from census returns about George Vincent in 1841, and Riddell in 1851 when he was seen to be the master of 16 men at 28 Alfred St.

**Bickley, Joseph**

1893 62 Lillie Rd, West Brompton, SW.

**[Bing Brothers]**

1902 Model Makers 3 New Union St, EC.

**Boekbinder, James M**

Marked as architectural modeller, but also carton pierre ornamental modeller. In 1894 started to add to his entry – 'architectural and ornamental; fibrous plaster'.
1892-1895 14A Elm St Grays Inn Road, WC.
1902-1906 11 Pratt St Camden Town, NW.
1913-1914 Boekbinder JM & Sons Ltd at Crown place, Kentish Town
1927-1928 Boekbinder Ltd listed as modeller, at same address as Battiscombe and Harris Ltd.

Bowden and Dorrell
1874-1883 Cavendish Mews, Charlt. St, W.
1884 8 Orford St Marlborough Road SW.
Mapping Sculpture: in Kelly's (1890) as a plaster of Paris manufacturer at 73 Endell Street.

Bowles, Arthur
1926 29 MMA Archer St Camden Town.

Bragan, Richard Alfred
1869-1879 54 Foley St, W.

Braun and Co
1902 Model Makers 236 and 238 Pentonville Road, N Offices 1 North St King’s Cross, N.
(opposite Metro station) Factory Cowcross Street.
Trade samples and inventions, working models made from rough sketches, demonstrating machines and apparatus for exhibition, law cases, or placing on the market inventors ideas worked out at moderate cost. Absolute secrecy guaranteed. Inventors assisted by trained experts. Oldest and longest firm of model engineers and experimentalists in England. Technical Advisers Inventions Section, Naval and Military Exhibition 1901.

Bridge, Jesse
1855-1862 Metallic model maker 44 High Holborn.
Mapping Sculpture: in Kelly’s (1860).

Bromfield, Thomas
1869-1875 275 Kennington Rd, SE.
Mapping Sculpture: born in Durham; in 1880-1881 at 262 Kennington Park Road, Lambeth, and 1881 at 146 Newport St, Lambeth. In the 1881 census as a sculptor, and in Kelly’s (1880) as an architectural sculptor.

Brookes Robert W
1882 38 Margaretta Terrace, Chls, SW.

Brown, G & A Ltd
1924-1938 167 Hammersmith Road, W6 also as modeler.

Brucianci, Domenico
1860-1862 5 – 8 Little Russell St, Covent Garden, WC, and 1 Leather Lane, EC.
1862 36 and 39 Russell St, Covent Garden, and 1 Leather Lane.
*Mapping Sculpture:* His dates were 1815 to 8 April 1880; listed as modeller, plaster caster, teacher of modelling at the RCA from 1853 to 1861; in the 1851 census as Professor of Modelling in Clay.

**Bruciani, D & Co Ltd**
First mentioned in 1892 under *Modeller*.
1911-1912 254, 256 and 258 Goswell Rd EC, late of 40 Russell St.
1913-1920 254, 256 and 258 Goswell Road, EC.
*Mapping Sculpture:* in Kelly’s Directories for 1851, 1860, 1890, and 1900; between 1890 and 1900 at 40 Russell St, Covent Garden, and in 1900 at 13 Bucknall St.

**Bull & Esdaile Ltd**
1913-1914 30 Stannery St Kennington and 65A York St Westminster.

**Butcher and Axtell**
1893, 1895 6 Rupert St W.

**C B**
1978-1984, 44/46 Camden Lock, Commercial St, NW1 8AF (see KB).

**Campbell, George Frazer**
[1851 Grt Exh: 17 Addington St, Lambeth; p833, entry 220 – executed the machinery of the model of Tiptree Hall Farmery for Mecchi].

**Casentini and Wilson**
1856 24 Hercules Buildings, Lambeth.
1858 Casentini, Mariano, *figure and architectural models, carver, plasterer and scagliola manufacturer*, 24 Hercules Bldgs.
1860 Casentini, John Mariano, 24 Hercules Buildings, Lambeth, S, and 19 Homer St, Lambeth, S.
*Mapping Sculpture:* Entered under Partnerships; with a patent, and entries in the censuses of 1851 and 1861, with other family members.

**Cherrys (Surrey) Ltd**
1988-1991 (+?) 62 Sheen Road, Richmond Surrey TW9 1UF.

**Chillingworth, Jno Charles**
1855-1857 32 Francis St, Westminster.
1858 described as *John Charles, architectural modeller, composition ornamentalist and projecting letter maker, 32 Francis Street Westminster Road S.* same address to 1866
1869-1893 29 London Road SE.

**Chipperfield, Richard**
1885-1895(+), 1896 26A Sekforde St Clrknl EC.
In 1890 listed under Model Makers as well – ‘machinery, buildings, ships and every description of models made in metal or wood.’ In 1895 had 99 Oxford St address as well, and from 1896 and 1897 99 Oxford St only.

1897-1903 1 & 2 Ham Yard, Grt Windmill St.
1902 also at 5 Green Terrace, EC.
1904 taken over by George Higginson and Co Ltd. But also see Salter.
1901 Richard Chipperfield’s advertisement under Model Makers reads:

Model maker: models accurately made from drawings or ideas; mechanical inventions worked out; The strictest confidence and secrecy may be relied upon; silver medal for good workmanship, International Inventions Exhibition London 1885; best workmanship and immediate attention; combined with years of experience enables us to offer those requiring models every possible facility to obtain exactly what they need at a reasonable cost. Over 5000 models already constructed for exhibition, litigation, parliamentary committees, scientific and other purposes, patentees offered every assistance in working out inventions.

Mapping Sculpture: found in Kelly’s for 1900.

Cockade Ltd

Coffee, Henry
1836-1837 Papier mache ornament maker, 6 Oxford Market.
1838-1842 [Robson’s] described as Architectural Modeller 6A Oxford Mkt
1839 [Kelly’s] and [Pigot’s] Modeller.
1840 Post Office – marked as Architectural modeler.

Mapping Sculpture: Dates 23 May 1793 – 31 May 1871; from family of artists; exhibited at Royal Academy 1819 to 1845; in Kelly’s 1851 and 1860 as ‘architectural and figure modeller’ and in 1851 and 1871 censuses as ‘modeller’.

Cribb, Thomas James
[1851 Grt Exh: Manufacturer, Kilburn; working landscape model, clockwork].
Then in 1854 Watchmaker, Kilburn.

Crooke, Edwin G

Cunningham, C S
1985-1986 Unit 10, Utopia Village, 7 Chalcot Rd, NW1 8LH.

Curley, Michael
1875-1884 47 Flood St, Chelsea.
1885-1897 49 Flood St, Chelsea SW.

Curley, Fras James
1897-1904 49 Flood St, Chelsea.

Mapping Sculpture: as an Organisation, in Kelly’s (1900).
**DBP Models**
1988-1991  Lee International Studios, Squires Bridge Road, Shepperton, Mdx TW17 0QD.

**Dawson, Miss R**

**Day, Richard**
1838-1840 12 Darlington Place. Described in [Pigot] 1838 and 1839, [Robson’s] and [Kelly’s].
1839 as **Architectural modeller.**
1840 12 Darlington Place, Borough Rd. marked as **architectural modeler.**
[1851 Grt Exh: modeller, 1 Rockingham Place, New Kent Road, Surrey. p830, entry 161 A – portico of Parthenon; Temple Church, Fleet St; portico of Pantheon; Martyrs’ Memorial, Oxford; chancel of gothic church; church window.].
1852 **Architectural Modeller in plaster of Paris, address as above.**
1854-1858 10 Webb St, Tooley St.
1860 40 Southville, Wandsworth Rd, S – last entry.
**Mapping Sculpture:** born c 1816 in Camberwell; Kelly’s Directories 1851 at 1 New Kent Road, 1860 40 Southville; 1851 Census ‘modeller’.

**Dickenson, James**
[1851 Grt Exh: artist; 1 Waterloo Place, Limehouse; p831, entry 181 - cardboard model of York Minster at scale of 1’ to 1/16 “].
1852 not in either alphabetical or street.

**Dighton, Thomas D**
[Thomas Edward Dighton, artist, at 14 George St, Adelphi, for 1 year only.]
1844-1848 **artist and modeller,** 2 Lower Grosvenor Place.
[1851 Grt Exh: **Artist,** 2 Great College Street, Westminster. P829, entry 142 Cardboard model of St John’s Church, Paddington, with Fowler; p835, entry 235A Preston Hall, with J Thomas; p830, entry no 160 part of the Record Office, from designs].
1852 Thomas Dibden, **artist.**
1854 Thomas D, **architectural modeller.**
1869-1872 12 Gt College St, SW.
**Mapping Sculpture:** son of Robert D, artist; born Westminster 3 Mar 1799, died Devon 31 July 1882; in 1841 at 49 Grosvenor Place; 1847-1851 2 Great Collge Street, 1860 12 Great College Street, 1881 Elm Cottage, South Molton; in censuses between 1851 and 1881 ‘artist’; married 1872; will; exhibited.

**Drew, Wm George**
1896-1899 134 Cloudsley Rd, N.
1900-1901 68 Richmond Road, N.
**Mapping Sculpture:** Kelly’s 1900.
Eagle Models
1988-1991 (+?) 8 Lebanon St, SW18 1RC.

Easton, John, Ltd

Eichardt and Heyner Photo
1908 MM 28 Canonbury Villas, Islington, N, architectural and engineering model makers, paper models, ‘Eichardt’ patent system.

Ellis, John Smith
1869 31 Nicholas Lane.

Elmes, Sidney Walter, & Son
1891-1894 62 Sydney St and 62 Bury St NW.
(1895-1899 no longer marked as architectural modeller).
Mapping Sculpture: 1900-1940 ‘Modeller’ (from directories).

Evans, J H
[1851 Grt Exh: producer; 2 Kender St, New Cross; p832, entry no 202 - St Mary’s Church; Swiss cottage, Glos, from engraving]
[Mapping Sculpture: Three found in Wales with this name; not identifiable.]

F E W
1950 20 Dimes Place, W6.

Farmer & Brindley
1877-1882 67 Westminster Bridge Road and Hercules Bldgs
1883-1912 63 Westminster Bridge Road SE. From 1908, Ltd Co. also listed under Model Maker.
1913-1921 Farmer & Brindley Ltd, still at No 63; in 1919 they had a much bigger entry under Monumental Masons, and continued to advertise in that category to 1928.
1922-1928 listed under both Model makers and Modellers.
1929 listed under modellers only.
Mapping Sculpture: 1851-1929 – listed as sculptors, marble merchants, stonemasons, marble quarrriers, architectural modellers, marble decorators, marble importers, and wood carvers.

Fernee, Herbert and George, and Fidley, John B
1914-1915 57 Bayham Place, Camden Town.

Forth Dimension Products
1991 53 Tudor Road, E9 7SN [Box advertisement].

Forzano
[1851 Grt Exh: 4 Greville St, Hatton Garden; p833 entry 220 - executed the animals for Tiptree hall farmer model with Vincenzo, Ruffoni, on behalf of Mechi].
Foster Association

Fowler, Charles
1834-1848 architect, 1 Gordon Sq.
[1851 Grt Exh: 1 Gordon Sq Producer; p829, entry 142, Cardboard model of St John’s Church, Paddington, with Dighton].
1852 1 Gordon Sq.
1854 architect and surveyor, 12 Furnival’s Inn.

Freeman, John
1869-1891 17 Gt Bath St, Clerkenwell, EC.
Mapping Sculpture: ‘William and John Freeman, stone and marble merchants, in 1851 Kelly’s Directories at 6 Wharf Macclesfield St, South London’.

Frewer, James R
1843-1848 Plumber, painter and glazier, 105 Upper Thames St.
[1851 Grt Exh: designer and manufacturer, 105 Upper Thames Street; p833, entry 219 – Gothic conservatory]
1852 Plumber &c .
1854 James Russell, Plumber and Glazier, same address.

Greenfield, Stephen
1988-1991 (+?) MM 24 Linton Lane, Epsom, Surrey KT 17 1DD.

Hamilton
1947-1949 MMA 95D Hammersmith Bridge Road, W6.

Hannaford Brothers
1927-1931 modellers 27 Swinton St, London WC1.

Hardy, Arthur Wm.
1869 21 Wilson St Finsbury, EC.

Herbert, J & Son
1844 [Thompson] 42 Parker St.
1854-1859 42 Parker St, Drury Lane.
1860 Herbert R & J at 42 Parker St; Herbert, William and Edward, 242 Euston Road.
Mapping Sculpture: 1851 Kelly’s ‘architectural modeller’.

Herbert, R & J
1860-1881 42 Parker St, Drury Lane, WC.
1882-1883 29 Parker St, Drury Lane, WC See below.
Herbert, William and Edward
1860, 1862, 1866, 1869-1871  242 Euston Rd, NW; see below.

Herbert, William
1872-1873 242 Euston Road.
1874-1875 9 and 242 Euston Road.
1876-1878 11 Euston Road NW.
1885 25 Crown St, Soho, WC.

Herbert, Rowland
1884-1889  29 Parker St Drury Lane, WC.

Hine, Edward
[1851 Grt Exh: modeller, 2 Orchard St, Kensington; p832, entry 201 – cardboard working model of a carriage]

Hitch, Nathaniel
1873-1874 257 Kennington Rd, SE.
1875 Harleyford Rd SE.
1876-1879 21 Harleyford Rd, SE.
Mapping sculpture: b 1846, died 28 Jan 1938; sculptor, architectural sculptor, sculpture modeller, mason, church decorator; apprentice to farmer and Brindley;1860; 1890s to 1901 studied at South London Technical School of Art, and exhibited prolifically at the Royal Academy of Arts; studio at 60 Harleyford from 1891 to 1926.

Hudson and Braaen
1926  11 Carteret St Broadway, Westminster (model makers specialising in Architectural models).

Industrial Design Models/ Design Developments, Ltd
1985 332 Kentish Town Road, NW5 2TH.

Image Industrial Models
1988-1989 30a West St Harrow, Middlx HA1 3EF.

Jackson, George and Sons
1883-1912 49 Rathbone Place W.
Jackson G & Sons Ltd
1913-1921 49 Rathbone Pl, W.
1922-1928  Jackson, G at same address; listed under Architectural Model makers between 1922 and 1928; model makers between 1922 and 1925; and G Jackson and Sons Ltd, marked as modellers from 1922 to 1933. All at the same address.
Mapping Sculpture: 1889-1900 ‘architectural modellers and plaster workers’.
Jackson and Braaen are listed at 46-54 Gt Titchfield St W1 in 1932 but not as architectural specialists.
Jarvis, Wm Reform
1866 modeller 881 Old Kent Road.
1880-1890 880 Old Kent Road.
1891-1921 18 New Cross Road SE.
1924, then 1926-1937, as Jarvis Wm Reform & Son, at 18 New Cross Road SE1. *Mapping Sculpture*: 1900 Kelly’s 18 New Cross Road, architectural modeler.

Johnson, J
1944-1951 MMA 38 Queensdale Road, W11 Later segregates himself as an architectural display maker, in 1956 and up to 1968.

KB
1977 44/46 Camden Lock, Commercial St, NW1 8AF – (then see CB).

Kandor Modelmakers Ltd
1986-1991 (+?) 37-42 Compton St, EC1V 0AP.

Kellett Scale Models Ltd
1988-1991 (+?) 31 Lind Road, Sutton Surrey SM1 4PL [used boxed adverts in 1990 and elsewhere].

Longbottom, Chas
1970-1975 as Longbotham.

Lubbock, Guy, Associates
1991 516 Wandsworth Rd, SW8 3JX [box advert above main listing].

Mabey, James
1860-1861 26 Paradise St, Lambeth, and 1A Princes Mews, Storey’s Gate, SW.
1862-1866 1A Princes Mews only.
1869-1872 1, 1A, 2 Princes Mews, Storey’s Gate – see below. *Mapping Sculpture*: Foreman modeller at the Palace of Westminster; in censuses for 1851 and 1871 as ‘plasterer’, 1861 as ‘modeller and plasterer’.

Mabey, Charles Henry and James
1873-1875 1, 1A, 2 Princes Mews, Storey’s Gate, SW.
Then just Mabey
1876-1883 Plaster and cement enrichments, cornices, etc, supplied from models in stock.
1883-1884 (added) tombs, monuments, etc to order.
In 1887 Mabey had an advertisement which read – *(Figure and Ornamental): plaster, fibrous plaster and cement enrichments for ceilings, cornices and supplied from models in stock; fonts, pulpits, reredoses, tombs, monuments etc in granite, marble, stone or bronze*. In 1891 adds ‘architectural models to scale’.
In 1893 added ‘sundials’.

*Mapping Sculpture*: three generations of Mabeys were found; Kelly’s 1960.

**Mabey, Charles Henry**
1899-1917 150A Vauxhall Bridge Road.

**Mace, Fred**
1837-1842 *sculptor and modeller*, 38 Lower Belgrave Place, Plimlico. In 1840 *POLD* – marked as *architectural modeler*.
1839 [*Pigot*] *sculptor*.

**Mandry, John**
1879 3 Hide Place, Vincent Sq, SW.

**Marchant, Adrian Ltd**
1988-1991(+) Chestnut Grove, New Malden, Surrey KT 3 3JL.

**Marshall & Co**
1904-1921 210 and 211 Sulgrave Rd, Hammersmith, W.
1922-1924 listed under *modellers*.

**Matrix Design Group**
1988-1991(+) 66 Offley Road, SW9 0LS.

**Mazzoni, Alfred**
1869-1876 25 High St Bloomsbury, WC.
‘*Architectural and general modeller, plaster cast figure maker, manufacturer of every description of ornamental work in composition, carton pierre, papier maché and cement*’; 25 High St, Bloomsbury, 4 Hanway St, Oxford St.
1877-1879 7 High St Bloomsbury.
1880-1881 23 High St, Bloomsbury.
1882 39 Endell St WC.
1883 25 Crown St Soho – no longer marked as *architectural model maker*.

**Mazzoni, Matthew**
1844 [*Thompson*] *Modeller*, 9 Princes St, Drury Lane.

**McCullock, John**
1884 384 Kennington Road SE.
1895-1899 at Harleyford Mews, but not marked as specialist in architecture. In 1898 becomes a Ltd company.

*Mapping Sculpture*: appears under the entry for the rather more famous Lawrence Turner, one of his pupils; as an organisation, in Kelly’s 1900 as modeller, architectural sculptor, monumental sculptor, and woodcarver.
McCutcheon, Kenneth  
1939-1940  *Modeller*, 5 Bradley’s Buildings, White Lion St, N1.

**McCutcheon Studio**  

Mechi, John Joseph  
1852 *Cutler and dressing case manufacturer*, 4 Leadenhall St.  
1854 Cutler, dressing and writing case, bagatelle and magic strop manufacturer, needle and pocket book maker.

Merrett, H S  
1847-1848 Henry S, *architect and surveyor*, 118 Chancery Lane.  
[1851 Grt Exh: *designer and manufacturer*, 82 Fetter Lane; p831, entry 172 – general hospital; P833, entry 220, Working model of Tiptree Hall Farmery, with Mechi, Campbell, Vincenzo, Ruffoni, Forzano].

Minavia Models Ltd  
1953 MM 330 Balham High Rd; *‘dioramas, aeronautical, architectural models in plastic, general display and advertising models’*.

**Models Manufactory**  
1930-1935 *Modeller* Causeway Place, 43 Newington Causeway, SE1. In 1935 listed as *Model maker, Architectural*.  
1936-1941 MMA Models Manufacturing Company.

Modulex 3 D Planning Ltd  
1965-1966 MMA 62 Brompton Road, SW3.

Moore, Charles E,  
1947-1954 MMA 22 Regents Park Terrace, Oval Road, NW1.

Morgan, Richards  
1952-1954 37 Moreton St SW.

Mossman, William  
1848 *designer and lace paper manufacturer*, 1 Canonbury Villas.  
[1851 Grt Exh: *designer and manufacturer*, 17 Rodney St Pentonville; p832, entry 204 – Great Exhibition building, from perforated paper].  
1852-1854 *designer and manufacturing stationer and lace paper maker*, at the same address.
Nutt, Frederick
1900-1904  49A Gough St WC.
1905 15 Theobalds Road WC.
*Mapping Sculpture:* Kelly’s 1900.

Owens, H C
1929-1931  modeller  11 Victoria St, SW1.

Pain, Henry
1895-1911  17 Leighton Road NW.
*Mapping Sculpture:* Kelly’s 1900 ‘architectural modeller’.

Papier Maché and Plastic Decoration Co
1888-1899  21 Wellington St Strand, and Mkt Rd Caledonian Road N, under *modellers* for 1888, 1889, described as *Architectural modeller* from 1891.
1900 last entry, with name reversed – Plastic Decoration and Papier Mache Co.

Parallax Models
1988-1990  44-48 Shepherdess Walk, N1 7JP.

Partridges Models Ltd
1925-1935  43 Johnson St Westminster, SW1 listed as *Model Makers architectural.*
However, also at 21 Buckingham St Strand, in 1932.
1936-1946  21 Buckingham St, Strand, WC2; from 1941 also at 24 John Islip St.
1947-1959  24 John Islip St, SW1 (not 1952).
Between 1960 and 1963 also listed as *MMA.*
*Mapping Sculpture:* 1930 Kelly’s ‘model makers’.

Partridge and Horton
1921 noted under *Model Makers as (architectural)* 4 & 5 Masons Ave EC2.
1922-1924 4 and 5 Masons Ave, EC2.

Partridges Models Ltd
1925-1935  43 Johnson St Westminster, SW1 listed as *Model Makers architectural.*
However, also at 21 Buckingham St Strand, in 1932.
1936-1946  21 Buckingham St, Strand, WC2; from 1941 also at 24 John Islip St.
1947-1959  24 John Islip St, SW1 (not 1952).
Between 1960 and 1963 also listed as *MMA.*
*Mapping Sculpture:* 1930 Kelly’s ‘model makers’.

Patteson, J & H
1907-1908  7 Bayley St, Bedford Sq, WC.
Mapping sculpture: Sculptors, stone and marble masons, monumental masons, based in Manchester.

Peacock, Alfred Wheatley
1930-1931  MMA  28 Stanhope St NW1.

Perkins, Joseph
1856 1 Manor St, Chelsea.

Piercy, George
1854-1858 modeller, naval  28 Judd Place, New Road.
1858-1888 Euston Road.
Mapping Sculpture: born c 1795, died Portsmouth 1882; naval modeller; grandfather to George photographer, and F H , winner of Royal School of arts silver medal in 1879 and sculptor 1879-1880; father of Frederick 1830-1891.

Piper, John, Ltd
1965, 1967  MM 27 Kew Road, Richmond, Surrey.

Pipers Model Makers Ltd
1988-1991 (+?) 12-16 Laystall St EC1R 4UB.

Plaster Decoration Co Ltd
1922-1923 30 Stannary St.

Plastic Decoration and Papier Maché Co
1900 21 Wellington St Strand, WC and Mkt Rd, Caledonian Rd, N.
Mapping Sculpture: 1900 Kelly’s under organization.

Plows, William
1881-1883 Shepherds Lane, Brixton, SW; thereafter not marked as architectural model maker.
In 1887, entry under modeller for Plows, G H (late William) at the same address.
Mapping Sculpture: several entries for this name, in the Lambeth area in the 1880s; died 1885.

Polz, Henry
1902-1911 2 Newman Passage, W.

Presentation Unit
1982-1991 (+?) 38-40 Glasshill St, SE1 0QR.

Priestley, Henry
1898-1911 7 Cliffords Row, Plimlico Road, SW.
Mapping Sculpture: [spelled Priestly]; 1855, 1881-1901 sculptor, architectural modeller, from censuses, catalogues and Kelly’s.
Project Models Ltd
1987-1990, Grd Floor, 18 Stukeley St, WC2B 5LR.
1991 change of name.

Prototype Projects
1991 [Box advert above main listing] 1 Greenfield, Royston, Herts SG8 5HN.

RAE Models
1988-1991(+) Unit 2, Corrie Road, Addlestone, Weybridge, Surrey.

Reid, Louis H
1913 Chitty St Works, Chitty St.

Roebank Model Making Services
1990 53 Tudor Road (see Forth Dimension) E9 7SN.

Ruffoni
[1851 Grt Exh: 4 Greville St, Hatton Garden; p833 entry 220 - executed the animals for Tiptree hall farmer model with Vincenzo, Forzano, on behalf of Mechi ].

Salter, Wm
1904-1907 5 Green Terrace, Rosebery Ave, EC. In 1905 under Model Makers; ‘several years with the firm of R Chipperfield’ – took over the telegraphic address.
1907 becomes Wm Salter & Co at the same address – 1908 listed under Model Maker.

Seal, Joseph
[1851 Grt Exh: Producer; Worship St, Shoreditch; p833, entry 218 – Crosby Hall, Bishopsgate].

Seale, Gilbert
1896-1897 14A George St, Camberwell.
1898-1912 22 George St, Camberwell.
Mapping Sculpture: 12 Feb 1862 to 5 Jan 1933; sculptor, architectural sculptor, architectural modeler.

Seale, Gilbert and Son Ltd
1913-1918 22 Lomond Grove, Camberwell, SE.

Seaton, Robert, Associates
1975-1985 23 Clifford Road, London SE 25 5 JT.

Shawcroft Models
1954 modellers [Bucks. Advert includes architectural models].
Sheen, Ernest
1931 *modeller*; also described as maker of scale models Oakley Place, Old Kent Road, London SE1.
*Mapping Sculpture*: 1878 to 4 Dec 1950; sculptor, medallist, sculptor’s assistant.

Shepherd, Epstein and Hunter Ltd
1988-1990 29-31 Foubert’s Place, W1V 7 HE.

Short, James
1862-1866 13 King Edward St, Liverpool Rd, N.
1866 also listed and marked separately, at 224 City Road, EC.
1869-1878 224 City Road, EC.

Shuttleworth, Don
1988-1991(+) *Architects*, Unit 22, 21 Wren St, WC1X 0HF.

Sigma Models
1988-1991(+) 162 Revelstoke Road, SW18 5PA.

Smart, William Jnr
1855-1857 41 Clifton St. and 18 Crown St, Finsbury.
1858-1862 *Architectural modeller*, (no jnr), 41 Clifton St, Finsbury, (no Crown St).
*Mapping Sculpture*: 1851 Kelly’s ‘modeller’.

Smith, Henry Alonzo
1837 *Architect*, 42 Norton St.
1839 [Robson’s] and [Pigot] – same address; [Pigot], described as *Modeller*.
1840 [POLD] *Modeller* 42 Norton St, Fitzroy Sq, marked as *architectural modeler*.
1844 [Thompson] same address.
1860-1861 3 Camden Cottages, Camden Town, NW.
1862-1866 12 Euston Square.
1869-1881 12 Euston Sq, NW.

Smith, Thomas
1843-1848 noted as *cork manufacturer* at 49 Eastcheap.
[1851 Grt Exh: (Jnr) *manufacturer*, 49 Eastcheap, City; p831, entry 167 – Royal Exchange in cork, scale 1’ to 1 1/16”; Monument in cork, scale of 1’ to 1/8”]
1852, 1854

Sparrow, John William
1905-1913 151 Oxford St W.
*Mapping Sculpture*: 1850 – 27 May 1941; woodcarver, designer, artist, architectural sculptor; various addresses.
Spiro, Joseph Beer
1908-1917  16 Brownlow Mews, Grays Inn Road, WC.

SS Models Ltd

Stephens, John
1876 42 Cumming St, Pentonville N.

Studio 10 Crafts Ltd

TECAD Film and Television Production

Tetra Modelmakers
1984 Studio A, Floral Hall, Covent Garden, EC2 8DG.
Then Tetra Design Services Ltd
1985-1991 (+?) at Unit 2, 28 a Grafton Square, SW4 0DB. Later became Andrew Ingham and Associates Ltd.

Tett, W J & Co
1900  7 and 12 Hanway St Works, W.
*Mapping Sculpture*: Kelly’s 1900 Architectural modeller and woodcarver.

Thomas and Frediani
1934 *Architectural model makers*, at same address.

Thomas, J
?1843-1848 Possibly John Evans, FSA, *sculptor*, 7 Lower Belgrave Place, Plimlico?
[1851 Grt Exh: *producer*, 9 Old Church St, Paddington; p835, entry 235A – design for Preston Hall; made by Dighton.].
1852, 1854 John, *Sculptor and architect*, same address.

Thomas Glenn Studios
1988  422a Upper Richmond Rd West.

Thorpe, John B
1904-1906 98 Grays Inn Rd, WC Listed under *Model Maker*, rather than *Modeller, Architectural* but noted himself as an *architectural modemaker* in his entry; how this was arranged is not clear, but may mean that he could undertake other forms of model as well.
1904 entry reads: ‘models of buildings, estates, works &c for exhibitors or law cases’. In 1906 invites readers to ‘Write for pamphlet with views of work executed during 20 years. TN 1011
Holborn. ‘Implies a start date of 1886. In 1909 the entry reads ‘maker of the noted models of “Old London” at the Franco-British Exhibition of 1908 – write for pamphlet with views of work executed during 25 years’

1917 entry reads ‘Thorpe, John B (architectural). Models of buildings, estates, works & for law cases or exhibitions’

1922 entry reads ‘Thorpe, John B (est 1883) (architectural)’, with the same address, and listed as both Model Maker and Model maker Architectural.

1913-1935 same address; from 1922 he was also listed under Architectural Model Maker.

1936-1940 same address; Model maker; entry reads ‘architectural, engineering and inventors models.’

1936-1946 at the same address, under Model Maker Architectural – ‘buildings, estates, works etc for law cases, exhibitions or inventors’.

1947-1970 (est 1883) same address – loses the end ‘e’ in Thorpe in 1954.

1970-1988 as Thorp Model Makers Ltd; has a range of box advertisements, under both architectural and model maker listings. In 1975 they also advertised as suppliers of materials for architects’ own models, under Model Makers materials, offering a complete architectural range for office mock-ups or exhibitions. They also featured under Model Photographers (Photoscope, eye level photography: a new direction in model presentation).

1979 description changes to Model (Architectural) Construction or Dealers.

1983 description changes again to Model (architectural) makers/constructors.

In 1991 they feature as one of the top five entries, above the main listing, at 88 Gray’s Inn Road, under Model makers.

**Thurloe Models (M Sewell)**

1956-1961  MMA  35 Thurloe Place S Ken SW7 (see Cockade Ltd).

**Thurloe Models Group**

1988-1991(+) The Studio, 44 Munster Road, SW6 4EW.

**Thwaite Charles N,**

1870 3 Craven St Strand.

**Thwaite, Charles Newson**

1871  3 Commercial Terrace, Commercial Road, Peckham.

1872-1884 23 Commercial Rd, Peckham.

**Tite, William**

1843-1848 architect, 17 St Helens Place, Bishopsgate St.

[1851 Grt Exhib: FRS, designer; 42 Lowndes Square; p831, entry 182 – portico and west front of Royal Exchange].

1852, 1854-1869, 17 St Helen’s Place, Bishopsgate St.

**Tozer, Richard**

1854-1866 22 Great Smith St, Westminster.
Tunstall, Richard
1891-1893  10 Roehampton St, Plimlico, SW.
1894-1896 also at 8 ½ Vauxhall Bridge Road, SW.
1897-1898 at Roehampton St and 2A Russell St.

Twining Models Ltd
1936-1940  Model maker  Northampton – first mention of London advertising by manufacturer from elsewhere. Described as engineering and architectural models for exhibition and technical instruction.

Unit Twenty Two
1985-1987 Unit 22, Wren St Workshops, Wren St, WC1X 0HF.

Universal Pattern Co
1946  269 Rotherhithe New Rd SE16. ‘See advertisers index, p 72’.
1947-1951 same address.

Vincenzo
[1851 Grt Exh: 4 Greville St, Hatton Garden; p833 entry no 220 – executed the animals for Tiptree hall farmer model with Ruffoni, Forzano, on behalf of Mechi]

Virgo, John
1856-1860  9 St George’s Place, Camberwell Rd.
1860 no longer marked as Architectural specialist.
Mapping Sculpture: 1860 Kelly’s ‘modeller’ at Atkinson Place, Brixton Road.

Walker, James
1947-1955  MMA 4 Brunel Road, Acton. But also as architectural decorator.

Webb & Co
1884 294 Euston Road NW.

West, A and Partners

White, Alfred
1876-1878 173 Upper Kennington Lane SE.

Wilby, Thomas [II]
Junior renter, St Bartholomew’s Hospital.
[1851 Grt Exh – Maker, St Bartholomew’s Hospital; cardboard model of St Paul’s cathedral].

Wright, Samuel & Co Ltd
Acknowledgements for illustrations

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Geological model 3721 with unnamed person inserting the final block
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