The University of Hull

Haptic Insights: Embodied Understanding in Digital Reconstruction

being a Thesis submitted for the Degree of Doctor of Philosophy in Drama

in the University of Hull

by

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Overview

> The study of the history of theatrical spaces, has no more to do with the understanding of the drama than the study of the history of printing has to do with the understanding of poetry. Joel Springarn (in Carlson, 1989:1).

This study examines the opportunities for the scholar to enhance their fundamental understanding of theatrical space through the **process** of computer reconstruction. Each case study explores primary evidence through 3D reconstruction and is supported where appropriate with selected cultural texts.

The area of visualised research for theatre history is a maturing discipline, and this study aims to build on the significant work undertaken by those who were responsible for establishing its validity and early guidelines for its appropriate use and deployment. This study does not aim to revisit this work but to extend the scope of our consideration of the complexities of the field in order to develop more responsive approaches to the development and dissemination of the findings of visualised research.

While the written elements of this work are substantial, the overall study should be principally thought of as Practice as Research (PaR). It is true that the practice of the reconstructive historian may not sit comfortably in models of PaR, particularly within disciplines related to Drama (for a more detailed exploration of this PaR in the wider context of existing discourse see ‘Procedural Engagement with Visual Research’, page 74), but the location of the **experience** of the researcher as practitioner is critical to an understanding of the study.

The PaR element of this study addresses the practice of the reconstructive historian, and as such is evidenced most explicitly through the modelled research but also through the histories explored through visualisation methodologies which may be viewed as part of the practice as well as discreet, written outcome.

The accompanying website presents an archive of the modelling practice of each case study. It should be noted that it is this **process** of reconstructive

exploration which delivers the core methodology of this work and as such it is the modelling process that should be regarded as the (PaR) element and not the artefacts that comprise the archive of practice.

The completed (and in most cases, developmental) models are available in their native 3DS format. For reference, each case study has been documented and presented as an archive including source material, a description of the approach taken and a selection of static and dynamic (moving, panoramic or object inspection) images of the final model outputs. The deployment of immersive VR has been avoided for reasons that are made clear in the main discussion in written element. Readers wishing to undertake a ‘spatial’ exploration of the models may access to the 3DS files (in the 'outputs' section), but the use of 3DS Max does require some specific expertise. As an alternative, all models have been made more accessible by a series of developmental thumbnails indicating the content of each model.

This work then is presented in three complementary parts. Each part is informed by the other two but there are no objective dependencies between them. I have titled the written sections as Part 1 and Part 2 but this is for ease of reference and this should not be taken as an indication of an intended reading order. The practical explorations have informed the discussion in Part 1 of the written element, but they have also been used as the underlying methodology of the histories presented in Part 2 of the written element. The Part 1 discussion addresses issues which will facilitate a better engagement with both Part 2 and the practice, The Part 2 histories will contribute to a contextual understanding of the practice but they are also an important part of the PaR element. The complexity of these relationships means that from a practical standpoint, one may engage with the three parts in any order.

The nature and order of the reader’s engagement with these parts should be informed by their status and experience as a visual researcher, and their familiarity with the field in general. It may be that readers with significant personal engagement with modelling practice will find that the PaR element (and related text in Part 2) provides useful illustrative reference points for a critical reading of the discursive elements of the text in Part 1. Indeed, this structure is

driven by my own engagement with the work as informed ‘reader’. It is likely though that for most readers an engagement with the PaR element (an archive of which is available on the accompanying website) will be essential to an informed ‘reading’ of the study as a whole.

It is recommended then that readers should engage first with the PaR elements. Each case study should be approached by a ‘reading’ of the material in the archive of modelling practice (supported by contextual material from Annex B) and then through the corresponding history presented in Part 2. While this will inevitably identify the reader as an ‘objective’ rather than ‘procedural’ user of the material (see page 26), it will provide a practical foundation, and critical position for an informed reading of the Part 1 discussion.

Please note that the archive also includes some elements which are intended to be illustrative of the Part 1 discussion and may be ignored in this initial engagement with the PaR.

The archive of the modelling practice has been provided at www.hapticinsights.com and should be accessed with the following login information:

User: phduser
Password: wren1674

This website also includes some materials which you will need to access during the Part 1 discussion.

The Part 1 discussion will explore issues that impact the effective use and communication of visualised research. This should not be regarded as a ‘handbook’ for engaging with this kind of methodology, nor a description of the process underlying the other parts of this study. I do not intend to directly address the case studies for reasons that will become clear. The case studies should be regarded as a distinct outcome, the commentary in Part 1 addresses wider issues. Part 1 does, in places, make proposals. There are some illustrative examples, but it would be more useful to think of Part 1 as providing a suggestion of paradigmatic approaches for the visual researcher rather than a toolbox of developed strategies.

In his study 'Vernacular Architecture and the Cultural Determinants of Form' Amos Rapoport identified three stages in the development of architectural space, these he calls, primitive, vernacular and high style. Vernacular architecture, he says is "achieved through the application of a system of shared rules… Since the model is shared and widely accepted, the resulting environments communicate clearly to their inhabitants; that is they represent lexical rather than idiosyncratic symbols" (in King, 1980:286) and it is these "idiosyncratic symbols" which he claims characterize architecture of a high style. His argument is that buildings that are conceived from an accepted understanding of the use for which the space is designed - as an embodiment of their primary function - are the buildings that most clearly communicate by that function. Conversely, "idiosyncratic symbols" are those that are peculiar to a particular group, symbols by which that group can assert their values and identity, which Rapoport identifies as the secondary function of a structured environment. The practice in this study will draw upon the tension between the modalities of vernacular and high style, and the existence of designed space as both lexical and idiosyncratic signifier.

Research Questions

1. How might we engage with the artefacts of theatrical space to better understand the artistic and cultural values embodied in it?

2. How might a close examination of space as defined by architecture or scenography inform an understanding of the implicit theatrical intentions of the minds that shape it?

3. How might the **process** of reconstruction inform an understanding of theatrical space as design in process rather than simply as a completed artefact?

4. How do processes of computer reconstruction offer alternative methodologies to the study of theatre history?

5. …

6. What is the role of 'framing' in the communication of the findings of the visual researcher?

Research Methods

Each case study comprises a set of historical theatrical spaces which occupy a moment of modal change. Where appropriate, cultural texts have been identified to inform or enhance the exploration of those spaces. Each theatre space is identified by a set of primary source materials which will form the basis of detailed exploration through the use of 3D (re)construction technologies. Each exploration will address the first three research questions.

Insights derived from this process will then be used to explore underlying philosophical/cultural concepts apparent in the tension between the vernacular and idiosyncratic functions of the space, in the context of the proposed companion texts (research question 4).

Research Outputs

The practical nature of the research process greatly problematises the communication of its findings. This is an issue embraced by fields of performance based research. Whilst current discourse on the issues presented by practice as research (PaR) provides useful conceptual models in this area, this study will demonstrate the ways in which current practice in the field of archive and documentation remains largely inadequate for research undertaken in this visual reconstructive mode.

It will be necessary then to develop more appropriate modes of discourse in order to address issues of practice. This is a significant concern in the field of historical visualisation and its importance in the scope of the final submission can not be underestimated. The outputs of this study are:

A) The PaR element – a portfolio of reconstructive practice available on the website

B) The written element in two parts:

   i) an exploration of approaches in the use of modelling as research tool and its appropriate documentation

   ii) a scholarly exploration of the academic findings of the research

As discussed above, most readers will find an initial engagement with The PaR elements essential to an informed reading of the work as a whole.

Access to the PaR element is via the website www.hapticinsights.com

User: phduser
Password: wren1674

Publications

Much of the material (both written and practical) presented here has contributed to publications and presentations elsewhere. For purposes of clarity, the following provides a reference to indicate the life of this research beyond this submission and the contexts in which some of the material presented here might be encountered elsewhere:

Theatre Royal Drury Lane – Wren 1674

Model contributed to THEATRON module on Theatre Royal Drury Lane (THEATRON, 2002).

Illustrations contributed to Thomas' article 'The Design of the *Théâtre du Marais* and Wren's Theatre Royal, Drury Lane: A Computer Based Investigation' (Thomas, 1999).

Contributed research to Channel 4 documentary series *Lost Buildings of Britain* (2004b; Thurley, 2004).

Hofman's Hamlet

Included in exhibition 'Shakespeare in Prague' at Columbus Museum of Art.

Exhibition (including images of reconstruction featured in Journal *Theatre Design and Technology* (Příhodová, 2017).

Chapter – Paradigms

Edited version of this chapter published in *Journal Theatre and Performance Design* as 'Haptic Insights' (Fergusson Baugh, 2018a).

Chapter – Reconstructing Process – Vlastislav Hofman's 1926 *Hamlet*

Edited version of this chapter presented as conference paper 'Visualising Process: Hofman's 1926 *Hamlet*' (Fergusson, 2017).

Edited version of this chapter published in *Theatralia*, as ‘Visualising Process: Hofman’s 1926 *Hamlet*’ (Fergusson Baugh, 2018b).

Introduction

On The Illusion of Democracy, Vernacular Form and The Printing Press

Marvin Carlson's *Places of Performance: The Semiotics of Theatre Architecture*, begins with the account of a lengthy and famous debate between the theatre professor Brander Matthews and English professor Joel Springarn, upon the usefulness of the study of the physical spaces in which historical dramas were performed:

> Matthews insisted that a proper understanding of the plays of Shakespeare, Sophocles, Molière, or Ibsen required a knowledge of what sort of physical stage each had in mind as he was creating his dramas, and to this end developed for students a collection of models of historical theatres which still may be seen at Columbia. Springarn, championing what he called "new criticism", which attempted to analyse the written text without the "distractions" of cultural or historical context, naturally deplored Matthews's interest in such matters. The study of the history of theatrical spaces, he once observed, had no more to do with the understanding of the drama than the study of the history of printing had to do with the understanding of poetry. (Carlson, 1989:1)

Carlson goes on to observe that Springarn's approach to literary texts (which might retrospectively be aligned with broadly post-structuralist views) is easily dismissed by modern theatre historians and that in truth, Matthews' position - that the study of historical texts is incomplete without an understanding of historical playing space and convention - now seems equally unsophisticated in the assumptions it makes about the importance of text, tacitly perpetuating the primacy of drama over theatre.

Carlson examines the semiotic significance of not only the playing space but also the audience domain and the chosen locale of the site of theatre (dramatic presentation). But in doing so he only really examines the status of the theatre (place of performance) as a sign, an historical statement of the social, cultural and political importance of theatre. Far from rejecting Matthews' stance, Carlson suggests an alternative, but not mutually exclusive approach to the study of architecture. To regard architecture as a sign rather than a condition is to begin to concede the centrality of the physical rather than the verbal elements of theatre, but the term 'semiotic' has itself become loaded with connotative

meaning. Carlson's study tends to concentrate on the **emblematic** function of theatre, but the significance of theatre architecture (in its strictest sense) is of course far more complex. This is in many ways intentional, Carlson explicitly seeks to redress what he perceives to be undue bias towards the examination of the stage and auditorium to establish wider definitions of the way that theatres mean.

As Carlson suggests, the study of urban semiotics does indeed suggest that architecture speaks of the society that creates it and of the function and ritual associated with individual buildings. Conversely (as is implied by Matthews' argument) it is apparent that the structure of the performance venue provides the context for any theatrical event and without some knowledge of this context we cannot hope to achieve any real understanding of that event. Furthermore, architectural psychologists such as Rapoport (in King, 1980), Canter (1974) and Kruze (in Arnott, 1977) hold that we are not only the creator but also the *subject* of our environment; that our behaviour and perception are deeply effected, even dictated by our immediate surroundings. So it is clear for all but the most dedicated post structuralist that a study of theatrical space is an essential element in any attempt to engage with theatre histories.

There have of course been many studies of theatre space but the work that has been done in this field has (to date) tended to suffer from the lack of a common vocabulary; Carlson's semiotic analysis has been preceded by the geometric examinations of Orrell and Mackintosh, Izenour's technologically obsessed distillation of an 'ideal' theatre and the Leacrofts' reconstructive historical surveys, and while all are equally valid, in the light of the others, each seems incomplete. Furthermore, the different agenda of each of these approaches has often forced those that practice them to very different conclusions: Carlson's search for significance has led him to concentrate on the most semiotically rich theatres, ascribing what is perhaps undue importance to the neoclassical and baroque. Mackintosh's belief in the significance of *ad quadratum* geometry led to the re-emergence of the so-called 'lyric' form (epitomised in the Glyndebourne Festival Opera, 1994) as the dominant force in 'millennial' theatre architecture. Izenour's view was largely responsible for the late twentieth century American trend for 'democratic' adaptable spaces which are equally suited to drama,

music and dance and in which all can see and hear equally well, but the compromises required in such spaces often leaves them bland in their uniformity, whereas Leacroft's desire to create a complete "illustrated survey of theatre building from ancient Greece to the present day" (Leacroft & Leacroft, 1984) led him to suggest a sense of completeness that his work did not always deserve while rarely undertaking any real analysis of the spaces with which he was concerned.

More recent work has focussed not on methodological approaches, but on the use of computer reconstructions in historical research, indeed it has only been very recently that the need to differentiate between the two modes of computer visualisation (process and output) has been widely acknowledged (see Baker in Bentkowska-Kafel et al., 2012). The popularisation of computer mediated illustration through television documentaries, and the practical demands these technologies place on the user have tended to separate output from process, focussing the attention of established researchers on the computer's potential to produce compelling visual material. But the high profile development of these technologies in the entertainment and cultural heritage industries has meant that at times the desire for visual impact has outpaced appropriate caution in its deployment. This is the area with which this study is concerned.

Much of the most important academic work undertaken in this field can be traced to work undertaken at the University of Warwick in the mid to late 1990s. David Thomas made extensive use of visualisation technologies to illustrate hypothetical explorations of the auditoria of the 1674 Drury Lane Theatre and the Queens Theatre Haymarket in his 1996 video *The Restoration Stage, From Tennis Court to Playhouse* (Thomas, 1996), later expanding on this work in his article 'The Design of the *Théâtre du Marais* and Wren's Theatre Royal, Drury Lane: A Computer Based Investigation' (1999).

At the same time, Richard Beacham's research group has worked exclusively with computer visualisation technologies since 1998. But the nature of their work has led to more significant advances in the understanding of the applications of visualisation technologies within historical study. The THEATRON project (2002), established in 2000 under Beacham's leadership, sought to produce a database of 3D virtual reality models of influential European theatres as a study

tool. With few exceptions, theatre historians and visualisation technicians worked together to develop computer models to be used for illustration and real time exploration in the final publication. However it quickly became apparent that through the process of reconstruction, significant revelations about the theatre spaces were being made not by the historians but by their technical counterparts.

The founding members of the Beacham group (Beacham, Dennard, Baker and Blazeby) have been directly or indirectly responsible for much of the scholarly debate in this field and have done much to establish questions of transparency and ethics as central concerns of the visual researcher. This study does not aim to challenge this work but to explore in more detail the precise nature of digital reconstruction as both process and artefact.

The research questions presented above represent a significant departure from the initial aims of the project and have undergone two periods of revision (though in this case ‘re-vision’ might offer more accurate framing). The first of these happened relatively early in the project and reflects a shift of focus from historical to methodological concerns. Initial project work demonstrated that while reconstructive practice did indeed render useful and communicable insights, the nature of the understanding developed by the model maker was so significant as to render other aspects of the original questions trivial by comparison. As a consequence, questions which dealt with phenomenological approaches to ‘reading’ theatre architecture, and proposals for approaches to the development of new theatre space were abandoned in favour of ones which focussed more closely on questions of process and methodology. These revised aims were articulated by an ‘intermediate’ set of research questions:

1. How might we ‘read’ theatre architecture to better understand the artistic and cultural values embodied in it?

2. In what ways might extant cultural texts and theories be used as a lens through which to analyse theatre architecture?

3. How might a close examination of space as defined by architecture inform an understanding of the implicit theatrical intentions of the age that engenders it?

4. How might the process of reconstruction inform an understanding of theatres as architectural design in process rather than simply as a completed artefact?

5. How might this 'embodied' understanding be communicated through research outputs which preserve a degree of accessibility to the mechanism of research?

Of these questions, the final one (accessed through practice which addressed the first four) seemed to be the most crucial… and the most elusive. Attempts to identify the precise nature of the difficulties in this area led to the second re-visioning of this work and much of the discussion in Part 1 of this submission (and to a change of title). It has become evident that research question 5 of the project was reliant on assumptions that are simply not justified, the most significant of which is the assumption that embodied understanding can be communicated at all. Much discourse in the area of tacit or embodied knowledge, and practice as research (PaR) concludes that such an endeavour presents profound difficulties relating to both the tacit nature of the knowledge (Polanyi, 1958; 1967) and to the communication of practice not directly experienced by the reader (Worthen & Holland, 2003; Nelson, 2006; Barrett & Bolt, 2007; Nelson, 2013) and this has led to a refocussing of that question towards an examination of the nature of the embodied experience and on models of communication. In its articulation of many of the assumptions that the written commentary aims to address then, research question 5 remains significant to the project in its absence and the final research questions addressed by this study should be read as:

1. How might we engage with the artefacts of theatrical space to better understand the artistic and cultural values embodied in it?

2. How might a close examination of space as defined by architecture or scenography inform an understanding of the implicit theatrical intentions of the minds that shape it?

3. How might the process of reconstruction inform an understanding of theatrical space as design in process rather than simply as a completed artefact?

4. How do processes of computer reconstruction offer alternative methodologies to the study of theatre history?

5. …
6. What is the role of ‘framing’ in the communication of the findings of the visual researcher

Rapoport’s division of architectural form into lexical and idiosyncratic symbols is a useful one in the context of the history of reconstructive practice as there has been a tendency for constructors to focus on either the primary, lexical function of theatrical space (Orrell, Mackintosh, Izenour) or the secondary, idiosyncratic function (Matthews, Leacroft, Carleson).

It is clear that given the historical status of theatrical space in acts of celebration and affirmation, theatres tend to represent a form which adopts both vernacular and high style modalities – an accepted model embellished with the connotations of fashionable style (be it neoclassical, baroque or modernist). Although (by its nature) the vernacular aspects of architecture are easier to analyse (the stages of Shakespeare, Sophocles, Molière do indeed speak of the mode of theatre each wrote from) the high style aspects are not. As Rapoport notes, the reliability of idiosyncratic symbols is ephemeral, and the neoclassical signs that spoke so clearly of magnificence and enlightened academic and artistic sensibilities to the Renaissance eye, now appear somewhat fragile in their antiquity. The use of high style attempts to make what is a temporary connotative meaning concrete, but in doing so they render the subtleties of this meaning illegible to subsequent generations.

Garlick’s study of the neoclassical form (Garlick, 1996) is an attempt to decode this high style; she charts the insurgence of the neoclassical into English theatre architecture in the eighteenth century, concentrating on the method in which the form crossed the channel. What I think she neglects to examine fully is the ideological adaptation of the style: There comes a point where any artistic movement becomes so widespread in its popularity that it has to be regarded as fashionable, and as such it is not always a shared ideology that drives that popularity. Although the introduction of this style into English architecture was engendered by the neoclassical, Palladian ideals of Jones and Wren, one has to accept that over a hundred years later such ideals had largely (in the public eye if not in that of the architect) given way to a desire to reproduce this style simply because it was fashionable to do so (a phenomenon exemplified by the

popularity of Robert Adam). In this case, the significance is not in the style itself but in its application. It is easy to identify a style that links Palladio's *Theatro Olimpico* to Victor Louis' Grand Theatre, Bordeaux and thence Holland's Drury Lane, but in terms of the codification of an ideology, this style does to some extent become irrelevant, diluted by modality in the same way that catwalk fashion is translated into high street retail. What is important here, having identified a stylistic fashion, is to observe the international and cultural differences in the expression of that style.

It is in these differences that we can begin to identify in a theatre's physical structure the expression of a theatrical ideal, yet we must also take care in our examination of these differences. Where they are nationally or culturally ordained such differences can be regarded as the perseverance of the vernacular elements of theatre architecture, but this is not *always* the case; we must examine whether the ideal expressed by the building's structure is one which is received or invented. The question of innovation is one which clearly cannot be regarded as a manifestation of the vernacular; there is no "system of shared rules" (Rapoport in King, 1980:286) and so the structure cannot be seen as a direct expression of functions (at least not the primary functions) of theatre. Yet the theatre that innovates can often be a far more powerful indicator of shifts in these primary functions where existing, shared rules are deemed inadequate – so that which appears idiosyncratic in its departure from accepted form might in fact represent a profound lexical statement; furthermore, the most innovative spaces have tended to be accompanied by an architectural treatise which sought to articulate the reasons for and theory behind the use of space. If they have attempted to create a new model through a dissatisfaction with the old, architects and commentators such as George Saunders (1790) or Francesco Algarotti (1767) were more than happy to analyse (or rather criticise) the old, particularly in terms of perceived architectural incompatibility with the ideals of theatre and the needs of actor and spectator. Indeed, it has often been the case that such treatises have been written not as an accompaniment to a new form

of theatrical structure but as a call for one[1]. These innovations have tended to concentrate on the physical form of the theatre space rather than the style in which that form should be executed, and the dynamics of form are strong indicators of the perceived functioning of theatre.

In order to isolate idiosyncratic signs, a comparative study is necessary and to that end, each of the case studies includes a **series** of reconstructions which facilitate comparative analysis. Where appropriate, the addition of texts contemporary to the subjects of reconstruction provides a kind of cultural grounding, a guide to how identifiable differences might be viewed. There are 3 case studies in total and the practice represented by each case study informs a scholarly article (presented in Part 2 – Architecture and Aesthetics)

Procedural (my) engagement with the case studies has informed the discussion in Part 1 - 3D Visualisation as Research Process, but this discussion is not a pre-requisite for objective (your) engagement[2] with the archive of practice nor with the findings represented in Part 2. The circumstances of the removal of question 5 have inevitably shaped the structure of the Part 1 discussion, which seeks to explore conceptual frameworks that might better inform our understanding of what it means to engage with reconstructive practice.

In his essay 'The Conduit Metaphor – A Case for Frame Conflict in our Language about Language' (1979) Michael Reddy explores the idea that the profound difficulties experienced by those wishing to discuss the shortcomings of language are inevitable and almost impossible to overcome. Stated in these terms, this view may seem redundant but Reddy's analysis focusses in some

[1] Algarotti's *Essay on the Opera* (1767) and Saunders' *Treatise on Theatres* (1790) were purely theoretical works suggesting 'fitting' forms for theatre, yet they were highly influential in the construction of theatres for more than a century afterwards.

[2] It should be noted that much of the discussion in Part 1 of this study adopts a position of "radical subjectivity" (Reddy, 1979:172) in which the possibility of objective communication is an absurd concept. 'Objective' is a good word and it is a shame to waste it. My use of 'objective' to describe a mode of engagement relates to the user's tendency to view computer visualisation as finished and closed 'object' and is closely related to distinctions that Ingold makes in the ways in which we relate to objects and materials (Ingold, 2013). Echo's of Reddy's view of communication are intentional.

detail on the existence of a metaphor which forcefully shapes the way we think and that it is one of the shortcomings of language that it cannot be effectively used to discuss its own shortcomings. He terms this kind of shaping metaphor as ‘generative’ and characterises this incompatibility between subject and mode of discourse as a ‘frame conflict’, a term which he has appropriated from Schön (in Ortony, 1979). The case studies in this project suggest that such a frame conflict exists in the visual outputs of reconstructive research. That is that the existence of visual representations of reconstructed space prevent an effective communication of the insights rendered by reconstructive process.

Reddy’s view and the view of Lakoff and Johnson who use his work as the starting point for their influential study of the ways in which we conceptualise knowledge (Lakoff & Johnson, 2003) is built on an inability to reconcile dominant modes of thought and practice with the central concerns of their field of study as they saw them. This intentional development of alternative ways of seeing is characteristic of many of the conceptual frameworks drawn upon in the Part 1 discussion.

Shöne’s initial identification ‘frame conflict’ led him to focus on issues of problem setting rather than problem solving in apparently intractable conflicts, and this approach became particularly resonant for me after my rejection of research aim 5. The aim itself seemed perfectly justified at the outset of the project, indeed the question of how we might communicate the finding of visual research simply seemed to be the only logical extension of the propositions which characterise the current position of the discipline, but the assumptions implicit in this aim ultimately prevented me from making any real progress. Shöne’s (and Reddy’s) suggestion that this failure might simply be caused by habitual modes of framing which prevent productive engagement with the issues under investigation has led me to seek out conceptual frameworks which explicitly seek to disrupt this kind of habituation. These alternative frameworks have been most evident where they have been proposed by those who (like Reddy) have identified frame conflicts in their own field that seem to lead to the development of conceptual models which are not consonant with their own experience of their discipline.

While the conditions of the development of these alternative frameworks initially provided useful analogues to my own experience as a visual researcher, it has

become clear that the frameworks themselves provide invaluable alternative approaches to ‘problem setting’ within this study.

This discussion then takes the form of an exploration of the impact of various forces on both procedural (visual researcher) and objective (end user) engagement with computer reconstruction. These forces (explored in terms of both dominant and alternative conceptual frameworks) include visual perception, the role of metaphor in basic conceptual functioning, assumptions about the nature of communication, the nature of tacit knowing and the unique perspective offered by acts of making. This discussion ultimately seeks to re-set the problem initially posed by aim 5 now more appropriately expressed as: 6. What is the role of ‘framing’ in the communication of the findings of the visual researcher?

Part 1:
3D Visualisation as Research Process

Context

Illustration and Interaction: computer visualisation practice in theatre history

The process of scholarly reconstruction has arguably been an essential part of our understanding of theatre history since Richard Southern's explorations of Georgian theatre practice (Southern, 1948; 1952) and Richard Leacroft's subsequent work on a range of historical spaces (Leacroft, 1973; 1982; Leacroft & Leacroft, 1984) confirmed the status of scenic and spatial visualisation in the field of dramatic study.

It was though, John Golder's exploration of the extant evidence of the *Théâtre du Marais* (Golder, 1984), and re-evaluation of Deirkauf-Holsboer's 1954 graphical reconstruction that introduced the potential benefits of computer visualisation for the theatre historian. Deirkauf-Holsboer's reconstruction was based on diligent archival research and a process of what is essentially linguistic reconstruction[1]. Deirkauf-Holsboer then engaged her father (a professional architect) to render this linguistic reconstruction into plan, section and crucially, isometric illustrations. These renderings were received extremely well and immediately confirmed with absolute authority by the academic community.

Golder's work though claims that this authority was based not on the quality of the research nor on the robustness of hypothecated choices but on the close association of this work with the architectural illustrations. In this respect, Golder

[1] There remains no pictorial evidence for the 1644 iteration of the *Marais.* The principal evidence for Deirkauf-Holsboer's reconstruction (and indeed any attempted reconstruction) is a carpenters' contract which describes the work to be undertaken when the theatre was rebuilt. It is a detailed document which superficially does contain all of the information needed to undertake at least a topographical reconstruction of the space. Deirkauf-Holsboer's reconstruction is based on linguistic analysis and is presented in narrative form. This methodology is not uncommon but where visualisations are developed *post hoc* to simply illustrate the author's intentions, I would characterise this as 'linguistic reconstruction' and this term will form part of a taxonomy of modes of visualisation research that will be developed later on. Closer examination of the evidence used here (to the degree required of reconstructive practice) though reveals a need for a considerable degree of inference and hypothesis.

articulates issues which have become the central concern of modern visualisation researchers; that the problem with the Deirkauf-Holsboer reconstruction does not lie in her work but in her father's illustrations and that "his skill as a draughtsman has lent his daughter's interpretation of the evidence an authority that it does not always warrant" (Golder, 1984:128). Or to put it another way, that the potency of the image defeats any attempt to make a detached evaluation of the underlying research. Indeed Deirkauf-Holsboer makes little attempt to explore the underlying research at all, merely presenting source material and final interpretation without any real sense of evaluative process.

In many ways, Golder's criticisms might be equally applied to Richard Leacroft's work (Leacroft, 1973) which follows a similar pattern. Leacroft's studies while not without value are certainly lent significant authority by the quality of his draughtsmanship. Unlike Deirkauf-Holsboer, Leacroft does include illustrations which are explicitly conjectural (though he rarely explores the nature of his conjecture) but he also almost always includes an isometric rendering of the space. The choice of isometric view is a significant and perhaps rather revealing one. The absence of perspective in the isometric view greatly reduces any sense that it may represent an impressionistic rendering of the space while its clear relationship to plan and sectional views lends it a degree of authority that we assume of the technical efforts of the architect but not of the interpretive or creative efforts of the artist. The possibility of the inclusion of detail and shading though also lends the viewer a sense of 'presence' that is not available in other schematic views. In this respect, the isometric view legitimises a sense of space that is in fact entirely interpretive and as with Deirkauf-Holsboer, this is the foundation of Leacroft's authority rather than any genuine sense of academic rigour. Golder's work then proceeds to undertake a process of linguistic reconstruction not unlike Deirkauf-Holsboer's, though in this case, Golder is careful to explore his personal interpretation of the evidence (but not alternative, rejected hypotheses).

As a 'postscript', Golder presents a short section on three illustrations included in the article but not directly referred to. These 'wireframe' illustrations[2] are presented to indicate the possibilities offered by the (at that time only bourgeoning) field of computer visualisation. Golder includes a series of *caveats* for the reader which relate to details omitted and to the use of 'placeholder' items that reference rather than show objects (though this is not a term that he uses) in the reconstruction:

> Such a system […] makes it possible for one to test the practical viability of one's theoretical reconstructions. As these illustrations show, it not only enables one to rebuild but actually go inside theatres which have long since ceased to be […] It should be noted that these computer-drawn views of the *Marais* show only the essential geometry of the interior and lay no claim to being complete or accurate in every detail. (Golder, 1984:149 - 50)

These *caveats* represent an embryonic attempt to describe contextual material which would later be described as 'paradata' by the London Charter (Dennard, 2009) and the 'state of knowledge concept' by Favro (Favro, 2006). One can't help feeling however that these illustrations have a similar effect on the reader as the Deirkauf-Holsboer illustrations. Indeed, in many ways, the authority conferred by the apparently scientific method and by Golder's constant use of language which is suggestive of an 'un-virtualised' reality (such as "rebuild" and "go inside") imbues his work with more authority than any draughtsman's view. This tension between visual experience and 'state of knowledge' is one which would later become central to Favro's work.

Following Golder's suggestion of the possibilities offered by computer visualisation to the theatre historian, there appear to have been no concerted efforts to explore these technologies until the experiments undertaken at the University of Warwick in the mid 1990s. This is perhaps not as remarkable as it might seem. While 3D software had been widely available since the early 1990s, it was 1994 that saw the launch of 'multimedia' PCs to the domestic market. This new generation of PCs made the video processing power required by these softwares accessible outside of specialist computing facilities. There followed a

[2] The term 'wireframe' describes a representation of a digital model which only shows the edges of objects rather than representing them as solid.

period of exploration of the dramatic possibilities of what had by then been termed 'virtual reality', including Mark Reaney's work at the Institute for the Exploration of Virtual Reality (i.e. VR) at the University of Kansas and Robert Wilson's 1998 production of Philip Glass' *Monsters of Grace* (Robert Wilson, 1999).

The extent of the deployment of visualisation technologies in a wide range of contexts complicates any attempt to provide analysis of the technology in general. The discipline of Digital Humanities is well established, but attempts to align the deployment of computer systems within the Arts and Humanities under such an umbrella are necessarily reductive, and tend to make assumptions which are unhelpful in this context. There are for example significant tendencies in Digital Humanities practice to focus on those technologies which deal with the collection, management and dissemination of information. Boonstra's survey of the field (Boonstra et al., 2004) acknowledges that this is a limiting factor by making a distinction between information and knowledge but his work (as is true of much discussion in the field) deliberately excludes the development of technologies which are aimed at facilitating the **development** of knowledge rather than informatics. His justification for this is significant to this study. He relates an event from the 1990 conference, 'History and Computing III, Historians, Computers and Data', in which Charles Harvey proposed a sense of definition during a plenary discussion:

> At the end of that conference, Charles Harvey philosophised about the nature of historical computing. Looking backward, he expressed ideas that proved to be widespread among computing historians and which have not particularly favoured the growth of historical information science as a methodological discipline. They marshalled feelings and attitudes that justified a turn away from the technical aspects. Pre-eminently, according to Harvey, historical computing must be concerned with the creation of models of the past or representations of past realities. It cannot be defined simply in terms of areas of application or applied information technology. Database systems or expert systems might happen to be of tremendous interest, but there is nothing specifically historical about such things. They are just general tools. Historical computing can only be defined in terms of the distinctive contribution it can make to historical research. As a subject, it exists on the methodological plane, and none of its historical methods owes anything to computers as such: historical computing can be done without computers. Computers merely make operational the concepts and methods that are the

> product of historical computing. Historical computing is a formal approach to research, that requires data and algorithms to be made explicit, and, as such, it is part of scientific history (Boonstra et al., 2004:31).

Boonstra's view of Harvey's statement seems to frame it as reactionary and obstructionist, that his view of information systems as tools indicated a denigration of the potential of computers to offer any real value to the historian. An alternative view (and one taken by this study) is that Harvey's distinction is essential to a meaningful understanding of this potential, his argument indicates that in order to understand the value of digital technologies one must regard technologies which facilitate existing processes (such as databases) as distinct from those methodological technologies which offer a genuine possibility to Harvey's "creation of models of the past or representations of past realities".

In 1996, the Theatre Department of the University of Warwick found itself host to two (largely rival) digital reconstruction projects. Richard Beacham's extensive work on the theatres of classical antiquity (and in particular the theatre of Dionysos and the Pompey Project) was to develop into the THEATRON project (THEATRON, 2002) while David Thomas made use of the illustrative strengths of visualisation technologies in his work on French and English theatres of the 17th century (Thomas, 1996; 1999).

Thomas' initial engagement with computer visualisation focussed on the possibilities of conveying a sense of presence to the viewer. The reconstructions of Wren's 1674 Drury Lane Theatre and Vanburgh's 1703 plan for the opera house in the Haymarket (undertaken by architects at *Atelier 4D* in Berlin and based on Thomas' linguistic reconstruction) were used in his video *The Restoration Stage* to explore audience point of view in these non extant spaces (Thomas, 1996). As with Golder, these reconstructions were unadorned and intended to only convey a sense of topographical arrangement. Their juxtaposition with video footage of real spaces that might be considered as part of the same tradition though is clearly designed to reinforce an implied reality of these virtual reconstructions.

It is Thomas' second project though that is more interesting for this study. While it is not necessarily evident in the text of the article, his revisioning of the Wren

Drury Lane and the *Théâtre du Marais* (Thomas, 1999) explored a different methodology. This time, working in close collaboration with a computer model maker (Fergusson), Thomas engaged in a more interrogative process. The email correspondence framing these reconstructions (particularly those relating to the *Marais*) begins to indicate the significant contribution and insights that the **process** of computer visualisation can bring to theatre history (Thomas & Fergusson, 1998). It is clear from the correspondence that the requirements of the process of the reconstruction not only render opportunities to test hypotheses based on source evidence but also make additional demands on the researcher to develop hypotheses of a greater level of detail than may otherwise have been sought. Each suggested solution engenders the development of further questions which relate to the application of these specific solutions within the building as a whole, demanding a methodology which is iterative and inevitably more rigorous (or at least more complete) than the illustrated linguistic reconstruction. While the potential for the computer model to expose errors is well documented[3], it is the possibility for this iterative procedural engagement which is more significant to this study.

More specifically, this significance lies in the ways in which those aspects of computer modelling which lend themselves to iterative discussion are manifested in the process of the individual researcher. It is important at this stage to make a distinction between two modes of reconstructive practice. Where a computer reconstruction is prepared by a software specialist under the direction of (or indeed in collaboration with) a guiding historical specialist there is an inevitable tendency towards modes of reconstruction which might be characterised as 'linguistic' (as with Deirkauf-Holsboer). In these cases, I would view the role of the software specialist as 'model maker'. Where the reconstruction is undertaken by the historian as part of their core methodology, I would view their role as 'visual researcher'. While at this stage, the difference may seem a simple nicety, the impact of forces of communication, procedural engagement and the insights derived from acts of making render the two roles

[3] This effect appears to have been first articulated in general terms by Paul Reilly (Reilly, 1989), but observations, of the effect in theatre historical practice can be found in Baker (1997) and Barceló (Barcelo et al., 2000).

so significantly different as to be representative of completely different disciplines. While the discussions generated by reconstruction as experienced by the model maker and historian can rightly be considered as iterative, for the individual visual researcher the process is much more complex. In his proposed 'Pentangle Method' (1997), Baker explores modes of conceiving of developing situations. The recursive cycle model has been identified as the dominant view of the life cycle of historical information (see Boonstra et al., 2004) and certainly provides a clear articulation of the experience as described above but Baker's view is that where the individual visual researcher is concerned, the process is not experienced sequentially but simultaneously (Figure 1).

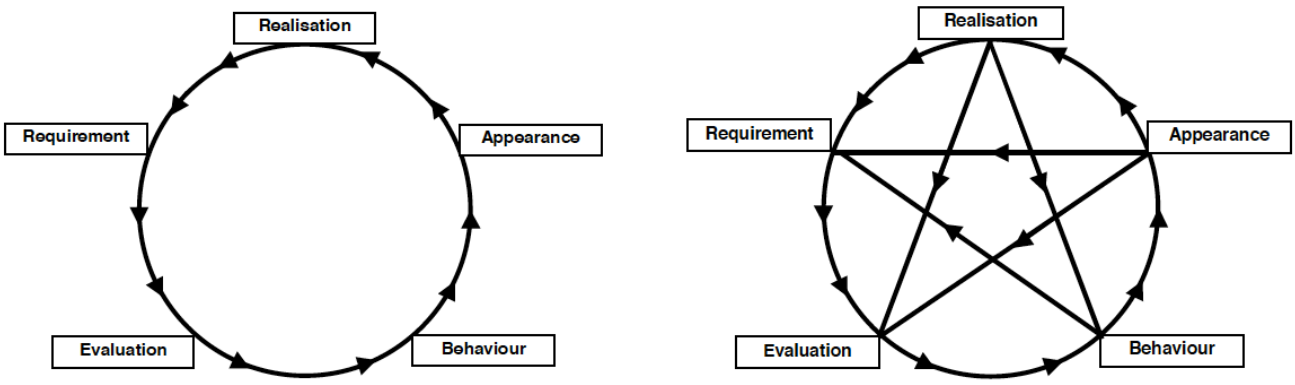


Figure 1. Models of development presented as a recursive cycle (left) and with Baker's proposed interdependencies (right) (Baker, 1997:71)

Baker's model goes some way to explaining the uniqueness of the experience of the visual researcher who deploys their reconstructive practice **as** methodology as it demonstrates the difficulties of articulating processes which unfold dynamically, and involve the simultaneous engagement of the researcher with all stages of a process which might otherwise be described as 'iterative'.

Though the publication of Richard Beacham's work followed that of Thomas', the Beacham's project was long standing and should be regarded as the forerunner. The location of Beacham's early work in this area (the Theatre of Dionysos, 1997 and the Pompey Project 1999) within a wider virtual reality project means that the work of his team tends to be both more coherent and more considered. From the outset, Beacham's plan was for a long term

engagement with visualisation technologies, the intellectual ambitions for which are summarised by Dennard:

> [Virtuality] offers new ways of knowing; and by making visible the unknown (for example by enabling researchers to hypothesize, in three dimensions, possible reconstructions of lost or hidden structures), it promises to make knowable things that were hitherto unknowable. (Dennard, 2002:36)

Beacham's early establishment of a research centre with dedicated physical and human resources and significant international funding has ensured that his remains one of the most significant interventions in this area, while the members of his team (in particular Dennard and Baker) have come to be regarded as some of the most important commentators on the methodological implications of visualisation technologies.

Beacham's early inclusion of expertise not only in the area of 3D model making but also in the area of real-time interactive virtual reality (VRML2) is indicative of his intentions for the projects to not only embrace the alternative methodologies offered by computer visualisation but also alternative routes of dissemination in which end users could 'explore' history in a more immersive way. As with the Thomas' *Marais* reconstruction, the early realisation that the computer's 'unforgiving and relentless demand' that components fit together (Beacham et al., 2002:231) indicated the principal methodological strength offered by visualisation technologies, particularly in relation to the evaluation of past research. This realisation though also presents the inception of the ideas later explored in *The London Charter*:

> If VR modelling has the desirable capacity to reveal gaps or inconsistencies in previous 2D studies by other scholars, because it demands comprehensive and consistent 3D data, one of the challenges it presents us is how to reconcile this same demand with the necessity we frequently face of working with incomplete materials ourselves. How do we 'mind the gaps'? (Beacham et al., 2002:233)

While practically these 'gaps' could be managed through the development of hypothetical models, these hypotheses are greatly problemetised as soon as they are presented through the medium of a virtual reality which does not make distinctions between the variable levels of confidence which might exist in the

final, visual output. The conclusion reached by the team was that any virtual outputs must be not only interactive but also interrogative.

When the various projects being undertaken by the team were consolidated under the THEATRON project (THEATRON, 2002) an attempt was made to address these concerns through the development of an interface which sought to contextualise the virtual model. This interface presented the 3D model as a navigable artefact which was accompanied by a scholarly commentary and a presentation of all source material. In theory this approach satisfied many emerging concerns about visualisation research but in practice it was only partially successful. Part funded by a European Commission grant, the THEATRON project was by necessity targeted at a non expert audience and this greatly limited the scope and detail of the accompanying discourse. Compared to other outputs generated by the Pompey Project (Beacham & Packer, 1999; Beacham et al., 2002; Beacham & Denard, 2003), the THEATRON module presents a relatively unsophisticated exploration of the material. This is of course not to say that the project was without significance (on the contrary, the practical and methodological concerns explored by the THEATRON team were the foundations on which *The London Charter* was to be built) but the focus of the outputs towards a heritage rather than academic audience exposed some of the shortcomings of accepted models of visualised research in the clear communication of academic discourse.

The Problematised Model: from Golder to *Gladiator*

The developing sense of 'visual hypothesis' in historical discourse evident in these early VR projects mirrors the development of the role of illustrator in the field of archaeology. Here, ethical issues relating to the dangers presented by the power of visual representation have been a principal concern to a field often faced with the need to explore incomplete sets of data through the introduction of proposed contexts of varying degrees of security. Though initially focussed explicitly on physical acts of reconstruction, this debate has close conceptual links to issues of illustration. Scholarly discussion surrounding the ethics of interpretation led to the development of a series of 'charters' for the treatment of historical sites from as early as 1931 (now managed by the International

Council on Monuments and Sites – ICOMOS) each intended to regulate the responsible use of conjecture in physical representations of archaeological findings. The *Venice Charter* (ICOMOS, 1964) for example allows for acts of conservation and restoration but places an absolute prohibition on acts of reconstruction:

> All reconstruction work should however be ruled out "*a priori*". Only anastylosis, that is to say, the reassembling of existing but dismembered parts can be permitted. The material used for integration should always be recognizable and its use should be the least that will ensure the conservation of a monument and the reinstatement of its form. (ICOMOS, 1964:3)

Hence reconstructive work such as that undertaken at Stonehenge (completed in the year of the charter's publication) renders its status as monument questionable, since it separates the "history to which it bears witness and from [*sic.*] the setting in which it occurs" (ICOMOS, 1964:2) by re-authoring that setting in a way which is unjustifiable in the terms of the charter. However, it is apparent that the language used in the *Venice Charter* implies a sense that there can exist a threshold of certainty in the presentation of archaeological findings, and that the pieces that have been excavated represent an evidential base which (while it may be incomplete) does represent an absolute 'truth'. The use of the term "*a priori*" in this context reinforces this claim but it is a claim which obscures rather than exposes the role of authorship in the presentation of histories. Who is it that decides the 'form' to which the monument is reinstated and on what authority?

It was not until the advent of the seductively compelling computer generated image (and the popularisation of reconstructive history through programmes such as Channel 4's *Time* Team (1994-2014),where our tastes for apparent authenticity exceed our desire for scholarly integrity) that these concerns led to the more explicit exploration of the ethics of interpretation and presentation expressed in the *Ename Charter* (2003)[4]. While still predicated on the management of historical sites of interest, the *Ename Charter* acknowledges the role played by authorship in the presentation of histories and includes in its 'principles', sections which address transparency of evidence and process, the

[4] (ICOMOS, 2003) Available online at http://www.enamecharter.org/ [accessed 31/7/2013]

crucial importance of multiple authorship (though interdisciplinarity) and perhaps most importantly, the absolute necessity to develop what the charter terms an 'interpretative infrastructure' (ICOMOS, 2003, principle 7.1) which ensures that the outcomes of any archeo-historical projects remain open and subject to on-going research.

In its interest in concerns relating to transparency and process, the *Ename Charter* begins to address concepts of importance to the practice-based historian but the solutions that it seeks are limited in scope in that they are specifically directed at the custodians of sites of historical interest, where concerns relating to evidence, context and accessibility can be addressed with relative ease through the curation of accompanying museum based exhibitions. How then might these challenges be addressed by researchers on non-extant sites who do not have the luxury of dedicated education facilities (nor indeed simple physical presence) for each of their readers? The publication of research findings through computer visualisation can provide researchers (and 'readers') with an analogue for the excavation site but when used as 'vital illustration' this presents the researcher with a number of practical and ethical challenges.

Diane Favro's seminal article 'In the eyes of the beholder: Virtual Reality re-creations and academia' (Favro, 2006) reflects upon her experiences of reconstructive visualisation at the Cultural VR laboratory of UCLA. While her work focuses on the creation of extensive interactive models of urban environments (specifically of ancient Rome), her observations are equally applicable to reconstruction of individual (and internal) spaces.

The article is principally concerned with the reception of reconstructive visualisation by the academic community. She notes that (in the US at least) academic interest in this form of research and representation has seen most development not in architectural or archaeological disciplines but in those relating to culture and heritage. These disciplines she characterises as wishing to pursue a 'didactic mission to educate lay audiences' (Favro, 2006:324). She indicates that much academic suspicion of virtual reconstruction focuses on its apparent reliance on simplification and hypothesis. It might be argued (though Favro does not) that this reveals more of our assumptions about 'lay audiences' than of the limitations of computer visualisation.

She goes on to say that academic practice in this area is also tainted by inevitable associations with populist revisionings made for the entertainment industry where the aim is to 'awe, not educate the audience' (324), this is of course not a new phenomenon (and she cites examples from the 19th to the 21st century) but it was perhaps specifically the extent and quality of visualisation work in the movie *Gladiator* (2000) that made this association – and the need to develop critical modes for the deployment of visualisation technology in academic study - crucially important. More recently, the games industry's adoption of modes which exploit our developing (and possibly inexhaustible) taste for historical fiction, in games such as the *Assassin's Creed* franchise (2007-Present), further problematises our relationship with reconstructive visualisation[5].

It is therefore perhaps an indication of the extent to which developments in digital imaging technologies have outpaced an appropriate development of legitimate concern, that there remains a deep distrust of computer generated imagery (CGI) in scholarly work, though Favro suggests a less explicit source of this discomfort:

> A cloud of suspicion continues to hover over all historical re-creations in academia ... A case could be made that this miasma is generated by scholars who fear their expertise might by compromised if speculation, rather than authenticity, is embraced. (324)

It is interesting that Favro presents the concepts of speculation and authenticity as binary opposites, and identifies in the academic community an apparent fear of speculation, particularly as the passing of time and commentary mean that there can be no meaningful 'authenticity' in the development and

[5] The deployment of 'real' structures (with historically accurate 'database entries') within fictionalised urban landscapes in the *Assassin's Creed* games engenders a sense of trust in the accuracy of the histories depicted. Indeed this is one of the strategies used by the games designers to reinforce the game's principal narrative (which deals with genetic memory) and is only confirmed by the inevitable sense of (admittedly uncanny) familiarity experienced by the player on encountering the virtual building's real world counterpart. Recent additions to the game include a 'tourist mode' in which the player may occupy the world free of the game narrative and engage with guided museum tours.

communication of narratives which claim to express a definitive sense of history[6]. In this respect Favro identifies in the academic community the same failure to acknowledge the inescapability of authorship that is manifest in the language and assumptions of *The Venice Charter.* In this regard, one might say that the visualised image does not engender speculation, it merely makes it manifest. It is of course this ability to make manifest (and by corollary, achievable and accessible) that renders computer visualisation an ideal methodology for researchers who wish their own historical reconstructive practice to remain open and available to other researchers.

She continues:

> An equally strong argument could be made that [this distrust] derives from a scholarly discomfort with visual representations of ideas. After all, images operate differently from texts. Once a visualization becomes part of the cultural memory, it gains a life and iconic power of its own, freed from academic constraints. Simply, images are potent bearers of meaning which forcefully shape thinking. Rather then addressing these characteristics, archaeology and related academic disciplines have largely ignored the rôle of images as constituents of knowledge. (324-325)

Favro's sense of image as constituent of knowledge though begins to address the potential methodological role that reconstruction can play in scholarship. The *caveat* that the image may gain an iconic power of its own when freed from academic constraints lies at the heart of any attempt to shape the documentation and presentation of research outputs based on such methodologies. She clearly articulates the paradox that jeopardises any attempts to de-problematise visualised histories:

> …while observers intellectually acknowledge that the virtual recreation is an approximation, not a *Doppelganger* for a past reality, this concept is almost immediately subsumed by the experiential power of the presentation. The heightened visual realism, kineticism, sensory stimuli, and inter-activity of Virtual Reality models eclipse any intellectualization of reconstruction theory… Even when the digital re-creations incorporate graphic distinctions to differentiate between the actual remains, reconstructions based on archaeological fieldwork, and those based hypothetically on analogs,

[6] For a brief exploration of subjectivity and the historian see 'On Writing Theatre History and My mother's Button Box' (in Baugh, 2005)

> the potent visual and kinetic experience of the models ‘trumps’ the ‘state of knowledge’ concept. (326)

My paper ‘Virtual Reality: it's not Meccano you know’ (Fergusson, 2011) explores the affective nature of the deployment of interactive virtual models as research output (as distinct from heritage artifact), focusing on issues of perception, interpretation and authority.

My argument is that in the deployment of VR technologies, the end user’s proficiency in handling information is extremely ambiguous and that this greatly compromises the value of any material presented in this way. It is likely that the end user has a highly sophisticated relationship with the interpretation of mediatised realities - certainly through screen media but also probably through gaming systems which bear close resemblance to VR research outputs. This familiarity strongly inflects the confidence with which users may engage with this kind of material. Furthermore the linguistic implications of terms such as ‘virtual’ and of course ‘reality’ impact on the attitude of the user to what Favro terms their ‘state of knowledge concept’. In this paper I suggest that the perseverance of the term ‘virtual reality’ in this context is significant since where this technology has received the greatest consideration and investment (the games industry) it has long since been replaced by the arguably more helpful terms ‘first person’ and ‘third person’, which are conceptually and linguistically linked to “the nature of the point of view of the user rather than the nature of the environment which they inhabit” (Fergusson, 2011).

Problematically, in most cases the confidence that the user has in the mode of delivery is in no way related to their proficiency in handling issues of interpretation and authority. So the greater the freedom afforded to the user to explore the product of the research, the less likely they are to genuinely engage with its process or implications.

Think Responsibly: The practice and ethics of the visual researcher

Since 2002, *The London Charter* group has sought to offer a framework for researchers using visualisation technologies in culture and heritage. As with its archaeological counterparts, it considers a range of issues relating to the ethics

of interpretation. But unlike the archaeology charters, *The London Charter* (Dennard, 2009, presented in full in Appendix A) moves beyond the consideration of the virtual artefact as illustration and approaches these issues with the explicit assumption that the act of reconstruction **is** an act of scholarship, placing on the artist the responsibility to make manifest the evidence, process and findings of their research in a form which is inseparable from the final image (which by corollary becomes of secondary importance). Any sense that the final image is the product of scholarly research made manifest by the faithful reconstruction of skilled technicians (a kind of archaeological 'photofit') is consigned to archaeological history. Its objectives are to:

- **Provide a benchmark** having widespread recognition among stakeholders.
- **Promote intellectual and technical rigour** in digital heritage visualisation.
- **Ensure that computer-based visualisation processes and outcomes can be properly understood and evaluated** by users
- **Enable computer-based visualisation authoritatively to contribute** to the study, interpretation and management of cultural heritage assets.
- **Ensure access and sustainability strategies** are determined and applied.
- **Offer a robust foundation** upon which communities of practice can build detailed London Charter Implementation Guidelines.

(Dennard, 2009:4)

The London Charter then seeks to encourage researchers to explore modes of presentation which are not reliant on simple images but on discursive or interactive models (static or virtual) which allow end users to enter into a dialogue with research outputs. In order to achieve this, *The London Charter* identifies the need to adequately document and evaluate any research sources, processes, methods and judgements which contribute to 'knowledge claims'. It identifies the need to clearly identify distinctions between decisions based on source material, contextual knowledge and inference or hypothesis (termed by *The London Charter* as 'paradata').

Hann (2010a:19 - 20) articulates these distinct data sets as:

- **Source Material and Metadata** – static information established prior to the process of visualization. 'Source material' relating to all diagrammatic data, sketches, textual accounts, and photographic sources. 'Metadata' is defined as statistical, descriptive or biographical information that relates to the source materials.

- **Paradata** – Included as part of the charter, this term was conceived by Drew Baker and is intended to account for the cognitive processes that impact upon the researcher's implementation and interpretation of a given cultural artefact. In Baker's conception, the process must be considered a distinct outcome of the project.

- **Data Artefacts** - the geometric forms, or 'data objects', which constitute the body of the visualization.

While *The London Charter* proposes an appropriate problematisation of virtual reconstruction and suggests a framework within which the researcher may consider their ethical responsibilities, it does not offer any concrete strategies for the navigation of these ethical responsibilities. Indeed, to date there have been relatively few projects which have sought to develop a structured approach to the presentation of paradata in theatre historical projects. The THEATRON project sought to make the products of reconstructive research available through user 'free roaming' (to borrow a term from the gaming industry) access to VRML versions of theatre spaces. Limited context sensitive information (text and images which might broadly be termed source material, metadata and paradata) was made available in various side panes within the web interface and updated as users approached key view points (or chose to be taken to them directly as part of a 'guided tour').

Though well intentioned, this approach was not always particularly rewarding for the end user for whom it was very easy to simply experience the product as a form of 'reality' while never engaging with (or indeed accessing) material which was essential to an understanding of the space.

This should not necessarily be taken as a criticism of the THEATRON project. Indeed, as we have seen, any attempt to present research findings as a form of 'virtual reality' is problematic, both conceptually and practically. Aside from any apparent linguistic claims of authenticity, virtual reality presents a series of challenges to perception, interpretation and authority, all of which are surrendered (largely without moderation) to the end user (Fergusson, 2011).

During the period of this registration, academic discourse has begun to shift in focus. Recent developments in reconstructive practice as a recognised mode of research has led to a refocusing on **exploration** rather than simple justification. The completion of a number of projects which have had the opportunity to respond to the concerns raised by the likes of Favro and *The London Charter* has provided the community with material which might be considered as part of a body of responsive evaluative research that moves beyond the process of problematising the presentation of practical historical research and into areas which might suggest concrete solutions (or indeed prove the complexities of the task un-navigable).

Rachel Hann's doctoral thesis explores possible approaches to the practical deployment of the principles of *The London Charter* within a reconstructive project (unrealised Utopian theatres). Her work is closely shaped by concerns expressed by The *London Charter*, and as such her principal concern is to explore ways in which the researcher might make manifest "multiple hypotheses and embodied paradata" (Hann, 2010a:69). In her exploration of the importance of paradata, she draws upon Polyani's views of tacit knowledge (Polanyi, 1958; 1967), particularly those that explore the role of subjectivity as a necessary component of knowledge. Specifically that:

> […] into every act of knowing there enters a tacit and passionate contribution of the person knowing what is being known, and that this coefficient is no mere imperfection, but a necessary component of all knowledge. (Polanyi, 1958:312)

This concept is essential to this study, though Hann's presentation of this relationship as a "compelling argument for paradata" (Hann, 2010a:20) does not fully acknowledge the complexities of Polanyi's model, in which tacit knowledge is comprised of two elements, one 'distal' element which relates to

communicable knowledge and one ‘proximal’ element which is particular to the ‘person knowing’ and not available via communication (Polanyi, 1967). In this regard, while Baker’s pentangle may begin to address the proximal elements of the visual researcher’s tacit knowledge, the concept of paradata on its own has clear limitations, not least in its assumptions that a/ transparency is the key to unlocking the process and that b/ it is in any way an achievable aim.

Hann ultimately rejects the use of a VR model in favour of the presentation of pre-rendered images with commentary (Hann, 2010b). It is not clear whether this choice is driven by the increased ‘narrative’ control over the user experience or by the improved image quality of the rendered image but what is clear is that without the material contextualising methodology (only available in the non-public version of her website), the images are so compelling as to render any sense of hypothesis all but invisible.

Hann’s media rich, interactive and context sensitive web based archives (Hann, 2010a) address many of the issues presented by *The London Charter* and should be regarded as a clear exemplar of current best practice.

As yet though all attempts to document modelling process have adopted an essentially static approach, which focuses on an exploration of models or images that are essentially treated as a sum of the source material and choices that are presented alongside a finished artefact. While this is a clear (and at least partially transparent) approach to the issues it does deny the user access to the **mechanism** of research – or in Baker’s terms does not acknowledge the process as a distinct outcome.

This presentation of research context is by no means exhaustive. For a detailed exploration of the background, conditions and discourse relating to computer visualisation as deployed in theatre history, Hann’s doctoral thesis is exemplary (Hann, 2010a). While this area might be considered as ‘emergent’, in truth it has moved beyond this stage of its development. Attempts to justify the validity of the importance of visualised research as both output and process are as unnecessary as any genuine attempt to refute Springarn’s position on the study of the physical conditions of theatre history.

Initial explorations of the novelty and potential applications of visualisation technologies have been largely propositional in nature, and have appropriately focussed on issues of justification, potential and transparency. But as we move into a period where the field has been established, there is a need for scholarly work in the area to explore the insights offered by alternative points of view.

The context offered here explores some of the views and observations which have characterised the field to date and attempts to establish a range of concepts which will be critical to the position adopted by this study. This material has in general terms addressed three areas:

1. Material which addresses procedural engagement with visualised research (Baker, Hann).
2. Material which addresses objective engagement with visualised research (Golder, ICOMOS, Favro etc).
3. Material which addresses the ways in which we might build bridges or conduits between the two (London Charter, Hann etc).

The following discussion will use these distinctions as a structural framework.

Methodology

While *The London Charter* accepts the importance of locating research practice in the public domain, it is Baker's notion that the **process** must be considered a distinct outcome of the project and which most closely reflects the position of modelling practice in this study.

Assumptions implicit in the *The London Charter* are problematic in this context, and attempts to reconcile these archival requirements with Baker's identification of the importance of the **experience** of the researcher and Favro's observations of the impact of visualised research outcomes on the reader seem to be intractable.

Model making is propositional in nature and the act of reconstruction provides the researcher with unique insights into the project at both the level of source material and data artefact (as defined above). In the most basic terms, the act of computer reconstruction requires the researcher to account for all choices either through direct reference to source material or by proposition and hypothesis. It is simply not possible to enter any data object into the reconstruction without making explicit choices about every aspect of its visual appearance. In this respect, the computer provides a kind of appropriately structured pedantry which requires the researcher to develop more complex and more sustained models of hypothesis than other forms of material research. The use of the term 'sandbox' to describe a computer environment in which one might freely test propositions is commonplace but the implied mode of engagement is important. Computer systems are ideally constructed to facilitate forms of 'play' within fixed or fluid systems. The ludic nature of the spaces that they are able to create has a profound impact on the experience of the visual researcher. As Miguel Sicart claims, "playing is a form of understanding" (Sicart, 2014:1).

It may seem paradoxical but the computer's need for these models to be broken down into precise mathematical detail leads to an intensely **human** relationship with the histories under investigation; the processes of computer reconstruction closely mirror the processes of the architect and the craftsman and the researcher inevitably develops sensitivity to historical working practices. So

much so that the process of reconstruction might often be more appropriately termed ‘re-enactment’, as the researcher not only asks what the architect did but also why and (crucially) how. This often leads to quite uncanny moments of ‘haptic’ insight where the understanding of elements of history are embodied rather than conceived.

Furthermore, processes of visual reconstruction allow the visual researcher to engage with modes of analysis which do not require the translation of visual source material into verbal form through acts of description. Propositional models may be developed that allow visual materials to be interrogated directly without the need to rely on forms of ‘linguistic’ reconstruction. The focus here on acts of (re)making, changes the relationship between the researcher and the history in question, making Polanyi’s coefficient between that which is known and the person knowing, critically important.

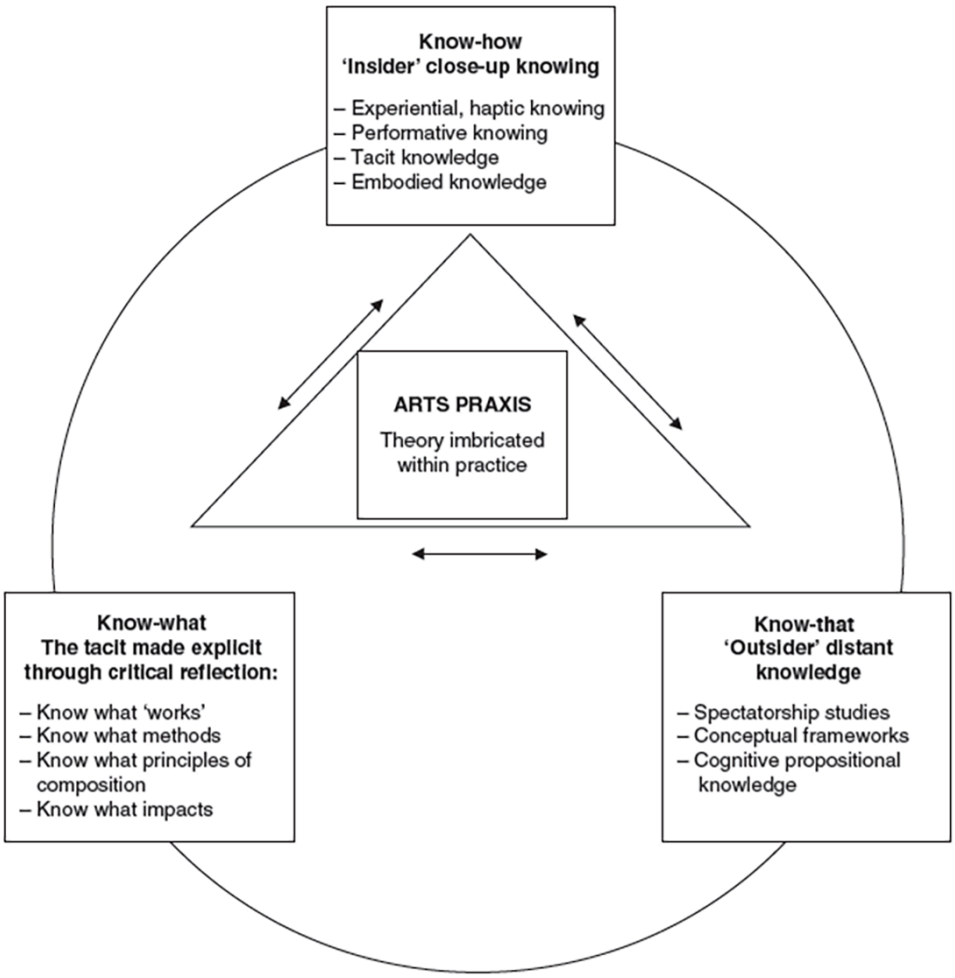


Figure 2. Robin Nelson's model of practice as research (Nelson, 2013:37)

Robin Nelson's model of practice as research (Figure 2) is a useful staring point in this context as it attempts to articulate the complexity of notions of praxis, but its primary focus is on performance practice. It fails to fully account for this form of 're-enactive' insight which does not relate directly to the skills of practice nor to the abstraction of critical analysis nor to contextual knowledge but lies somewhere between. The addition of a category of 'know-because', derived from 'know-how' and feeding into categories of 'know-what' and 'know-that' would be necessary in order to fully engage with Nelson's conceptual framework.

Nelson also locates material relating to accounts of process (in the terms of *The London Charter*, 'paradata') within the 'complementary writing' part of a submission. Here again, it is necessary to make adjustments to his scheme. In Baker's model, the process is a discrete outcome and should not then be simply subject to a narrative account but acknowledged as a practical artefact and subject to appropriate archival techniques. These techniques should preserve a sense of outcome while ensuring that the user retains access to the *mechanism* of research. The experience of practical researchers though (and the implications of Polanyi's model), indicate that a complete communication of the tacit elements of knowledge is in all likelihood simply not possible.

It is possible that discourse in this field has been hampered by a form of 'frame block', and this study aims to explore the potential offered by a focus on problem setting rather than problem solving. To this end, Part 1 will develop a conceptual framework which draws upon a range of challenges to dominant modes of discourse in related fields. The approaches offered by the likes of Polanyi, Schön, Reddy, Gibson and Ingold have been selected because of their explicit focus on attempts to disrupt 'frame block' in their own disciplines[1].

The question of what might constitute 'appropriate archival techniques' in this context may fall outwith the scope of this study, but a discussion of the nature of what may be archived, what remains tacit and how objective engagement with visualised histories might be facilitated are central to the aims of the project.

[1] Though only Schön and Reddy have used this term, it is clear that the work of Polanyi, Gibson and Ingold has developed out of a dissatisfaction with habitual assumptions which encourage a view of their respective fields which is not consonant with their observations and experience.

Research Questions

1. How might we engage with the artefacts of theatrical space to better understand the artistic and cultural values embodied in it?

2. How might a close examination of space as defined by architecture or scenography inform an understanding of the implicit theatrical intentions of the minds that shape it?

3. How might the process of reconstruction inform an understanding of theatrical space as design in process rather than simply as a completed artefact?

4. How do processes of computer reconstruction offer alternative methodologies to the study of theatre history?

5. …

6. What is the role of 'framing' in the communication of the findings of the visual researcher

This study exploits the opportunities for the scholar to enhance their fundamental understanding of theatrical space through the **process** of computer reconstruction. The primary method for addressing these questions is through a series of case studies. Each case study explores primary evidence through 3D reconstruction and is supported where appropriate with selected cultural texts.

The case studies have therefore been chosen because of their existence at a point of nexus between Rapoport's concepts of 'vernacular' and 'high style' in building design (in King, 1980:286), and in each departure from the vernacular there exists a thesis or manifesto made concrete. Each set of theatrical spaces aims to address the first three research questions by proposing a possible approach to the reading of these spaces.

Case Studies

The Italian Renaissance and Perspectival Art: the framed stage

The Italian Renaissance theatres *Teatro Olimpico* at Vicenza (Palladio, 1585) and *Teatro all'antica* at Sabbioneta (Scamozzi, 1590) - present a clear blending of vernacular and high style. Each owes a great deal to the scaffold theatre as articulated by Serlio in his *Treatise of Scenes* (1545) but each also presents a

very clear 'idiosyncratic' message. The interest in these theatres lies in the framing of the stage space. The development of permanent perspectival scenery in Vicenza and Sabbioneta is conceptually closely related to the development of two dimensional perspectival painting and concepts of the *città ideale*. The theatre at Sabbioneta, while demonstrating a strong sense of this context, represents a departure from classical idealism and the development of a new Italian architecture which acknowledges tradition while also making ideological statements which locate it within the project of the *città ideale.*

Reconstructions of these spaces have been undertaken from extant plans and surveys of the spaces.

Drury Lane, the English Model: The civic architect and Romantic sensibilities

Between 1674 and 1822 the Theatre Royal Drury Lane underwent a large number of alterations, remodels and rebuilds. 1791-1822 represents a particularly active period of evolution and a very public debate between actors and architects on what should constitute appropriate theatrical space. There is a clear tension between the vernacular form supported by theatre professionals and the high style proposed (and executed) by a series of acclaimed (and fashionable) architects. This discordant moment can be better understood through an exploration of the tension between neoclassicism and burgeoning Romanticism with its attendant fascination with the pictorial and the sublime.

The 1674 Theatre Royal Drury Lane has been reconstructed from Wren's section 'play house' (1674) and a ground plan proposed by Fergusson. Architectural plans for Henry Holland's 1791 iteration of the building are available.

Reconstructing Process - Vlastilav Hofman's 1926 Hamlet

This case study extends the principals explored in the reconstruction of architectural space to other visual forms, in this case, scenic design. The 1926 production of *Hamlet* is of particular significance in a range of contexts. It was Karel Hiller's return production following a career hiatus occasioned by a devastating stroke in 1924 and marked the beginning of a more reflective stage of his career (Burian, 1982:67). It was the production in which Hofman

apparently shifted his focus from explorations of solid matter to explorations of open space (Burian, 2002:127) and has been further identified as significant in its use of screens to articulate that space (Burian, 2007). The significance of this particular production is further evidenced by the rich and varied original design material which has been preserved in a variety of archives (principally those held at Prague's National Theatre and National Museum and in the Burian holdings of Columbus State University).

The case study takes the form of a series of reconstructions of each stage of Hofman's process as evidenced by the extant artefacts of design. Insights into the formal developments of Hofman's design are enhanced by analysis informed by his critical writing on the subject published in his article 'My Evolution in Theatre' (Hofman, 1926d).

Each of the above case studies explores the history of the artefacts in question visually, through acts of reconstruction which are informed (in varying degrees) by texts which locate theatrical space in its contemporary context. Case studies were undertaken as a series of propositional models which explore the ways in which visual source material might be incorporated into a developed understanding of the histories in question. In this way, it is possible to explore the precise ways by which the 'unforgiving and relentless demands' (Beacham et al., 2002:231) of visualisation might make 'knowable, things that were hitherto unknowable'. (Dennard, 2002:36).

The critical and analytical reflection on these case studies in part 2 of the written element will serve to illustrate ways in which the processes of computer visualisation may enrich and inform an understanding of the complexities of the discourse between theatre as place of performance and theatre as cultural text (research question 4).

The final research question will be addressed in Part 1 of the written element which may be regarded as 'complementary writing' (in Nelson's terms). Here I will address the nature of both objective and procedural engagement with visualised research, and potential approaches to the design of strategies aimed at bridging gaps which might be identified between the two.

As discussed earlier, most readers will find that an early engagement with the practical elements (particularly those presented on the website) essential to an informed reading of Part 1, there are points in this discussion where you will be invited to engage with various tasks for the purposes of demonstrating concepts and knowledge which cannot be conveyed linguistically. Some of those tasks are physical in nature (materials have been supplied with this thesis) but some are digital and may be accessed via the website at www.hapticinsights.com. For ease of reading, these digital materials have been identified as illustrations of the written discussion.

Paradigms

Behold! A Paradox

Academic study in the field is often characterised by *caveats*, contradictions and paradoxes. So much so that it may seem that the possibility of finding lasting solutions to the problems posed by the archiving and presentation of visualised reconstructive research are at best impossibly illusive. It may be possible to develop a less pessimistic view if one considers that this does perhaps have more to do with the medium than the task. Our relationship with technology is volatile and our perception of (and engagement with) mediatised and interactive entertainments[1] is extremely variable. The introduction of stereoscopy, for example, to cinema (as early as 1889) and to gaming (in the 1980s) though briefly very popular, was ultimately dismissed as a simple curiosity, while experiments with this technology in live performance (Mark Reaney's work at ieVR in Kansas and Robert Wilson's 1998 production of *Monsters of Grace*) were met with similar scepticism. Nevertheless, more recent developments in cinematic 3D now make stereoscopy commonplace. It is easy to attribute this to advances in technology but in truth, the technology deployed in *Life of Pi* (Lee, 2012) is essentially the same as the technology deployed in *House of Wax* (1953)[2].

In this respect, it is more significant that it is the user that is in flux, not the technology, and this perhaps accounts (in some part) for the difficulties in articulating the issues and proposing solutions experienced by researchers (like Favro) whose principal focus is on the virtual output at the point of delivery. Though the artefact output (the 3D reconstruction) remains the focus of any meaningful dissemination of findings, it is essential to challenge assumptions about the form it should take, particularly in respect of its assumed status as the point of interface between end user and researcher and the implications this has

[1] I use the term here to include a range of cultural artifacts from gaming to fine art.

[2] Though revivals and broadcasts of *House of Wax* have often relied on red/blue anaglyph presentation (put your glasses on now), the original release did in fact deploy passive stereoscopy through polarized glasses as with 'modern' 3D cinema.

for the mode of user interaction and for the relationship between model (artefact), context (data and metadata) and process (paradata).

The Paradox

It is indeed the nature of this relationship that lies at the heart of many of the issues expressed (though not necessarily fully explored) by researchers such as Baker and Hann. It is clear that a visual mode of presentation is essential in conveying a sense of space – which is almost inevitably one of the principal aims of reconstructive research. While the *caveats* may be legion, they simply do not outweigh the obvious necessity for illustration and the potential that interactivity lends to the development of critical discourse. To suggest otherwise would be perverse. Paradoxically, as Favro has noted, it is equally clear that the visual image is not conducive to critical interrogation.

Reddy's exploration of the 'conduit metaphor' in human communication (Reddy, 1979) identifies a need for what he terms 'paradigm-consciousness' towards problematic issues which lie at the heart of his discipline (linguistics). He argues that detailed linguistic study indicates that approximately 70% of our language about language is derived from a single coherent metaphor in which communication is viewed as a conduit and language a container for ideas (which are by extension viewed as objects)[3] and that this paradigm forcefully and persistently shapes the ways in which we think about language in a way which prevents us from adequately discussing that phenomenon (which he characterises as a 'frame conflict'[4]). In this case, the conduit metaphor means that we conceive of language as a shared system with automatic function, and

[3] Reddy's study suggests that the remaining 30% of language used may be built on metaphors that fall outside of this paradigm but that they are not sufficiently coherent as to challenge its dominance.

[4] He appropriates the term from Donald Schön who developed the concept to explore issues of 'problem setting' in social policy (in Ortony, 1979). Schön uses the term to describe a situation where conflicting metaphors are applied to an issue which as a consequence appears to be irresolvable. He argues that in many cases, it is the framing or setting of a narrative that presents difficulty rather than the issue itself, and that closer attention to the setting rather than solving of problems in social policy may render more productive outcomes. In Reddy's model though, it is the metaphor and the subject that are in conflict.

that any failures in communication should be exceptional and are implicitly the fault of the communicator – if goods are damaged in transit, it is the fault of the person that packed them, not the recipient. This attitude is demonstrated in phrases such as 'you are not getting your ideas across', 'your argument is empty', 'your words are hollow' etc.[5].

Reddy acknowledges the impossibility for the reader to step outside of this paradigm and take an objective view of the difficulties posed because in his model, language itself is radically subjective. He does however propose an alternative metaphor which allows the reader to become conscious of the paradigm with a view to temporarily suspend its influence, and allow the reader to access the implications of his developed understanding of the issue. In Reddy's alternative (termed the 'toolmakers paradigm', in which communication relates to the form and use of created tools), language is a system for communicating experience that is not shared, and as such the ability to assume any sense of shared understanding in communication relies on the constant maintenance of that shared understanding by those involved in the transaction. In this way, he re-classifies language from a 'success without effort' system to an 'energy must be expended' system and observes that common sense suggests to even the most casual observer, that this is a more accurate description of our everyday experience. Yet the persistence of the conduit metaphor…

> …objectifies meaning in a misleading and dehumanising fashion. It influences us to talk and think about thoughts as if they had the same kind of external, intersubjective reality as lamps and tables. Then when the presumption proves dramatically false in operation, there seems to be nothing to blame except our own stupidity or malice. It is as if we owned a very large, and very complex computer – but had been given the wrong instruction manual for it. We believe the wrong things about it, and teach our children the wrong things about it, and simply cannot get full or even moderate usage out of the system. (Reddy, 1979:308)

[5] As an interesting footnote, Reddy notes that there is a single instance of language which ascribes failure in issues of communication to the 'reader' but that the absurdity of the notion that 'you are reading too much into this' simply reinforces the dominant paradigm.

Reddy's frustration with dominant modes of thought and discourse, embedded (in this case) in a coherent and persistent metaphor, was driven by the observation that his understanding of his field was not consonant with the narrative suggested by the tools accepted by the field in general. He argues that once one embraces 'paradigm-consciousness' it may be that articulating the situation as it presents itself, demonstrates that apparently insoluble problems are at least in part solved by engaging in alternative metaphorical narratives – in Schön's terms that a more productive approach might be to focus on 'problem setting' rather than problem solving. In this way, the relevance of Reddy's conceptual model is that it offers an alternative way of approaching issues articulated by Favro, Baker and *The London Charter* by suggesting that re-framing the narratives by which we have articulated the perceived problems associated with visualised research might be a more productive approach than simply trying to solve those problems as they have been articulated.

The following discussion will explore three aspects of digital reconstruction practice which may offer alternative ways of seeing (and conceiving of) issues relating to the field. Broadly, these will address, visual research as experienced by the end user (objective engagement), visual research as experienced by the researcher (procedural engagement) and issues of communication between the two.

Objective Engagement with Visual Research

The Perfidy of Images

Favro (2006) and Hann (2010a) have both identified ways in which interactive and visual material actively disrupt critical engagement on the part of the end user, while Thomas reported that the first visualisation of the *Théâtre du Marais* was mistaken for a recent photograph by one colleague who manifestly knew that the space was no longer extant (Thomas & Fergusson, 1998). It is clear that the phenomenon of 'passive disengagement'[6] represents a *caveat* of which

[6] This will become an important concept in this work. It is perhaps axiomatic that critical disengagement is an inherently passive act, but the term is used here to indicate a persistent and unconscious form of disengagement, the action of which is analogous to Reddy's perception of the impact of the conduit metaphor on the way in which we conceive of communication.

we must be aware, but we might usefully at this stage explore **why** this might be the case. To date, all significant debate on this subject has focussed on the quality of the image. The assumption has been that the closer that the image approaches to a convincing rendering of reality - whether this is in the form of Deirkauf-Holsboer's architectural isometrics (see Golder, 1984) or the compelling CGI of *Gladiator* (see Favro, 2006) – the more willing the end user will be to accept it as reality. This has led to the proposition of a number of strategies which either seek to limit the quality of (Dennard, 2011) or simply annotate (Hann, 2010b) the image. Though these projects have led to some work which has improved the possibilities for engagement by the end user, the assumptions on which they are predicated reject the possibility of more fundamental barriers to critical discourse. This in turn has limited the scope of proposed solutions.

The process of visual perception involves significant acts of unconscious interpretation. Traditional conceptual models of visual perception suggest that our brain produces a representation of what we see which does not necessarily replicate the objects as they appear, but schematises them in a way which allows us to recognise them under various conditions (for example when they are partially hidden or in motion). This process of 'conceptual constancy' enables the brain to extrapolate incomplete or ambiguous information in order to make sense of visual stimuli. What is important here is that this process happens passively and unconsciously and perhaps most importantly, that it happens precisely because the brain is unwilling to admit incomplete or ambiguous visual material (that this is the case is evident in the fact that we cannot see our own blind spot, even though it obscures approximately 5% of our field of vision).

This sense of conceptual constancy is of course also the process which accounts for the effectiveness of optical illusions. Indeed, though entertaining in their own right, many forms of optical illusion have been developed by psychologists (and historically by empiricists and phenomenologists) specifically to test the processes of perception. For the purposes of this study, I would like to focus on two groups of illusions, the 'figure-ground' perception illusion and the so called 'impossible construction' illusion.

Demonstration 1 – Blind Spot

In Appendix 1 you will find materials to allow you to examine optical and perceptual aspects of your own blind spot. The 'blind spot effect' is quite persistent so the experiment may take a little practice.

Example 1 will allow you to identify the existence of the blind spot. Hold the image in a landscape orientation and close one eye. Look at the cross that corresponds to the open eye. Hold the image about 6-8 inches from your face. By moving the image back and forth slightly you should be able to find the point at which the second cross drifts though the blind spot of the open eye. Rather than appearing as a dark patch of no vision, the cross should simply disappear as your processes of perception reconstruct the missing part of the blank page. Since this reconstructed part of the image does not include a cross, we must assume that the reconstruction is contextual and not based on a persistent recollection of the missing information.

Example 2 extends this demonstration. If you are able to successfully and repeatably achieve the outcome in example 1 move on to the second image and repeat the experiment. This time the image shows 2 coloured spots in a field of text. The complexity of the image means that repeating the result of experiment 1 requires considerably more concentration, but this time you will note that the spot is not replaced a white empty space but a reconstruction of a sense of text that you are in fact not actually seeing.

The 'impossible construction' illusion is most clearly expressed in the figure known as the 'Penrose Triangle'[7]. The use of capricious perspective suggests a form which we know to be impossible when conceived in three dimensional space but in perception, the brain attempts to resolve the image into a less problematic form. Generally speaking it achieves this by accepting an unproblematic interpretation (suggested here by the corners of the form) and discarding visual information which is ambiguous or contradictory (see Figure 3). This phenomenon (which I will term 'critical disengagement') reduces the scope for the viewer to make conscious intellectual judgements about the fundamental nature of the image in general, and in particular, judgements that relate to issues of trust.

It is interesting to note that various presentations of the Penrose Triangle can be more or less successful in engendering this response. In Figure 3 we see a graphical interpretation of the phenomenon but the photographic interpretation in Figure 4 is less easily reconciled, as the 'normalising' processes of perception are disrupted by the knowledge that this is in fact a representation of a three dimensional reality (in this case, the photographic quality of the image is indeed crucial). The photographic image then becomes less easy to accept. This makes

[7] Though Penrose himself adapted this form from the work of Oscar Reutersvärd who first proposed the figure in his 1934 work *Opus 1 n° 293 aa*.

the image more disturbing but crucially also demonstrates the possibility of disrupting the process of ‘passive disengagement’.

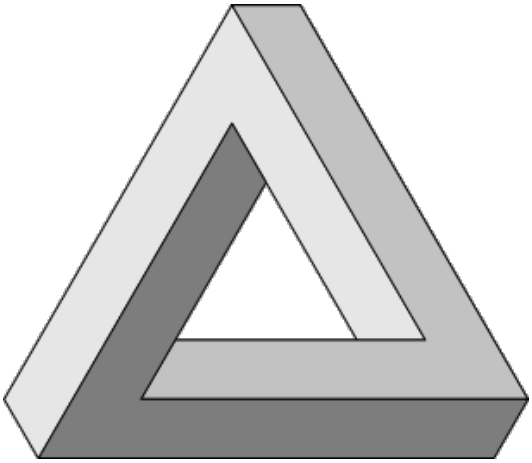


Figure 3. The Penrose Triangle

Figure 4. Penrose Triangle rendered photographically

The work of M.C. Escher is well known and much of it built on the principals demonstrated by the Penrose Triangle. In Escher’s work though, the embellishments of architectural form greatly enhance this effect to the extent that it is often the case that the viewer has to make a conscious effort to see the illusion as a contradiction rather than simply allowing the processes of perception to normalise the image into an unproblematic depiction of a possible reality (Figure 5).

This effect of the ‘impossible object’ illusion is entirely reliant on the passive and unconscious processes of perception because “these are not, of course, impossible objects…but perfectly possible pictures. Pictures provide us with allusions to objects, and tricks can be played with the transition from three to two dimensions”. (Wade & Swanston, 2001:28). The visual sleight of hand occurs precisely when the brain is occupied in the process of schematising the two dimensional image into a recognisable three dimensional form and at a point when it is busily filling in the gaps in which there exists the possibility of ambiguity.

So the experience of the ‘impossible object’ illusion demonstrates that it is the user and not the technology that lies at the heart of problem. Much has been made of the difficulties of the seductive image (indeed it was the original title of

this chapter) – Favro for example has identified the quality of the reconstruction in the film *Gladiator (2000)* as particularly problematic. Her argument is effectively that in the eyes of the viewer, if it looks real then it must be real, and similar arguments have been proposed by Hann (2010a) and Dennard (2009).

Figure 5. *Ascending and Descending* M.C. Escher, 1960

The Penrose Triangle though demonstrates that the extent of 'critical disengagement' is not reliant on the quality of the image (nor indeed on the quality of the draftsmanship – see Figure 6) but is simply a function of perception. In this respect, Golder's 'wireframe' reconstruction of the *Marais* (1984) is as compelling as Thomas' photorealistic one (1999). It is not the absence of room

for interpretation that is the problem but the brain's compulsion to fill in any gaps that might exist.

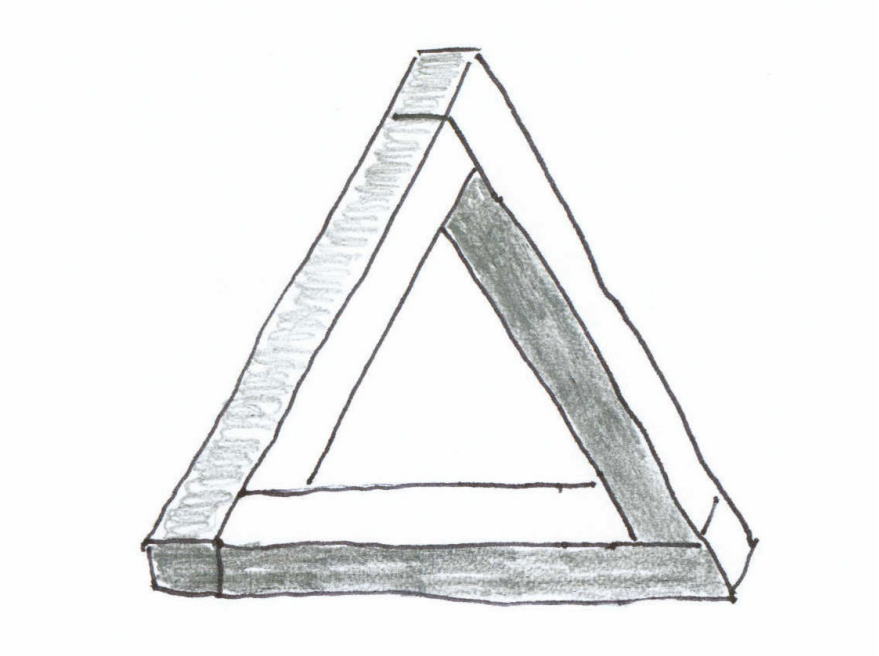


Figure 6. Our acceptance of the Penrose Triangle
is not reliant on the quality of its rendering.

For the researcher who aims to explore the nature of ambiguity, possibility and contradiction, this does of course render the two dimensional image extremely problematic in its tendency to disengage the viewer from critical thought. Indeed, it might even suggest that a physical model would be far more conducive to critical discourse than any visualised outputs that computer based reconstructive processes might produce, since even immersive stereoscopic 3D is predicated on the processing of two dimensional images.

The British stage designer Bill Dudley has articulated the relationship that theatre professionals have with physical models:

> Many directors and theatres still request a model… When we are all much more down the road to 3D on computer, that might change, but for now the fact that each carpenter and scene painter picks up the model that they're looking at and inspects it from every angle several times an hour is significant. I would only be confident if I had the tangible model to offer them. (Davis, 2001:80)

In conversation, he articulates this relationship differently. People **understand** the model in a way that they do not necessarily understand the sketches or the

storyboard. He describes the initial model box presentation as everybody's favourite bit of the first day of rehearsals and identifies in our affinity with models an association with childhood:

> The funny thing about the model is that it appeals to the child in everybody. If you do a beautiful miniaturised model people fall in love with it. (Davis, 2001:81).

In his observations on experience, Dudley makes it clear that the physical model suffers none of the issues of passive disengagement so problematic in computer visualisation. On the contrary, the physical model seems to engender an intensely interrogative relationship with the reality to which it refers. By invoking a strong sense of imagination and play, processes of passive disengagement are 'short circuited' and the attractiveness of the model invites discourse. The physical model becomes richly imbued with possibility in a way that Favro claims that the virtual model cannot.

James Gibson's revolutionary work in the area of 'ecological' views of perception (Gibson, 1971; 1973; 1979) takes a similar view on the privilege of physical objects in visual perception. In his conceptual model however, the picture is problematised in different ways. For Gibson, conceptual models of how visual perception works (particularly in respect of pictures) simply did not explain his observations of visual perception. Theories which assume that visual perception is a simple 'stimulus-response' system, a result of the analysis of forms presented as images projected on the retina, and transmitted to the brain assume that the 'normal' mode of seeing is static and that perception in motion is a special, advanced form of vision. But this fails to acknowledge the way in which the sense has evolved. Furthermore, he suggests that experiments that test theories of visual perception through the exposure of subjects to visual stimuli (usually in the form of static pictorial images) simply perpetuate this assumption.

Gibson's conceptual model stresses the importance of visual **information** rather than visual stimulus and suggests that visual information is generated by perceptual engagement with an environmental optical array which is in flux. If we regard 'seeing' as an act of perception (rather than simply the signals of optical sensors in the eye) then we must concede that we do not 'see' objects

in the static form in which they are presented to our senses in any given moment. As with the concept of 'conceptual constancy' discussed above, when we 'see' an object, we observe it in its entirety. As you look around the room, your retina receives a limited view of your chair, the lamp, this thesis, which presents only one surface, but your perception acknowledges these objects as complete, and in this respect you can 'see' even the occluded surfaces. For Gibson it is important that the optical array is in constant flux. The head moves, we walk around[8], objects of interest are inspected (approached, physically moved) and it is only through observing changes in the ambient optical array that we are able to construct visual information. Gibson argues that as we do this, we are able to establish a sense of the constant overriding characteristics of an object, in Gibson's terms 'formless invariants' (and similar to the 'schema' described above) and that it is these invariant characteristics that comprise visual perception (Gibson, 1973). This view requires an absolute rejection of the validity of the widely accepted notion that the still image might represent a simplified exemplar of visual experience. Indeed, in his definitive work on the subject, *The Ecological Approach to Visual Perception* (1979) Gibson places his exploration of what pictures might represent in the final chapters precisely because in his view "the kind of vision we get from pictures is harder to eunderstand than the kind that we get from ambient light, not easier" (Gibson, 1979:267).

Gibson provides an example of the 'formless invariant' in action. He suggests that a child understands a picture of a cat principally because he has experienced a cat, he has seen it move and play, he has been interested in it and moved his head and body in order to inspect it. He has not committed a range of forms of the cat to memory (top view, side view etc) but has in essence established the formless invariants of 'cat' which he is then prepared to acknowledge in a range of pictorial representations (photograph, silhouette, cartoon) as cat (1979:271). Gibson argues that any meaningful understanding of what a picture is should be founded not on an understanding of the image as a retinal reproduction of a reality nor on a reading of the image as sign system,

[8] Gibson identifies these conditions as discrete forms of vision which he terms 'ambient' and 'ambulatory'.

but on the status of the image as communicating ‘formless invariants’ which recall ‘normal’ (i.e. dynamic) vision in an arrested form. The ‘formless invariant’ is then a form of knowledge.

An extension of this model offers an explanation of Favro’s observations on the problematic nature of the reconstructed image.

Imagine the same child viewing a picture of an elephant. The child has never encountered an elephant but does understand what a picture is (because he **has** encountered a cat). Based on the model ‘cat’, the child is able to extract a sense of the ‘formless invariants’ which reference elephant, and all is well. The child has acquired knowledge of ‘elephant’ but depending on the nature of the picture the child’s knowledge relating to ‘elephant’ may be more or less closely related to the reality ‘elephant’. If the child has read the *Babar* books or seen *Dumbo*, it will be likely that the formless invariants that constitute the child’s knowledge of ‘elephant’ will contain some significant inaccuracies. Consider the child’s surprise when they first encounter a real elephant.

Engagement with pictures (and Gibson includes moving pictures in this) requires that we ascribe ‘knowledge’ status to those elements that we acknowledge as the formless invariants of the image. The child has limited experience and so it is easy for us to dismiss this phenomenon as part of a learning process, but the same effect frequently forms part of our own experience. It is possible to be astonished by the real world experience of artefacts that we think that know well from pictures. From personal experience, I have been rendered speechless by my first encounters with Picaso’s *Guernica* (Picasso, 1937) and the *Teatro Farnese* in Parma, not through simple awe or delight but because a moment of incompatibility between my ‘knowledge’ of those artefacts (generated by pictures), and their reality led to a moment of absolute incomprehension which disrupted my engagement with my **actual** environment (and yes, awe and delight). Moments like this highlight processes which often remain invisible to us but it is clear that processes which ascribe authority to pictures are more fundamental than is suggested by concepts such as ‘the camera never lies’. Gibson holds that in their separation from ‘normal’ vision, pictures simply do not have ‘ecological validity’ (Gibson, 1979:268).

Figure 7. The Rubin Vase (in Donaldson, 2017b)

Gibson's view notwithstanding, experiments in optical perception do at the very least offer demonstrations of the issues relating to our perception of pictures. The second set of illusions which may be of interest here relate to the phenomenon of figure/ground perception. In these optical illusions, ambiguities over which elements may be regarded as background and which as subject lead to the existence of two discrete images that cannot be perceived at the same time. The most famous example of this is expressed in the Rubin Vase (Figure 7) which presents an image that may be identified either as a vase, centrally located in the image or as two profiles facing each other. The viewer cannot see both images at the same time but experiences a 'gestalt switch' when moving from one interpretation to the other.

With familiarity, the user may be able to easily switch between 'seeing' one image or the other but it is often the case that in an unfamiliar example, the identification of one image actively prevents the user from seeing the second possibility without real effort and explicit guidance (see Figure 8 and Figure 9).

For this study, the significance of this is twofold. First it demonstrates the brain's unwillingness to accept ambiguity in visual stimuli even when it can be clearly perceived. Second it demonstrates how compelling and (importantly) persistent this effect can be. This phenomenon might offer an alternative explanation for the inability of Favro's subjects to access the 'state of knowledge concept' once exposed to the virtually reconstructed environment.

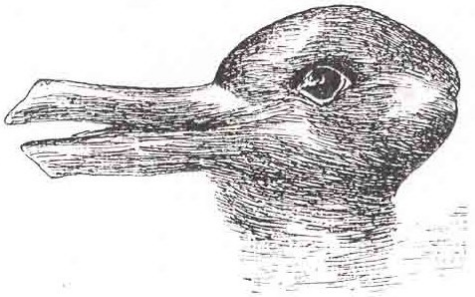


Figure 8. Duck-Rabbit (in Donaldson, 2016)

Figure 9. Eskimo-Face (in Donaldson, 2017a)

Obviously to empiricists and phenomenologists, the purpose of these optical illusions is to demonstrate the processes of perception *in extremis*[9]. but these processes are still in operation even when they don't result in problematic interpretations of visual stimuli. As a final demonstration of the profound impact these processes have on our ability to interrogate visual material in a critical manner I would like to look at a mode that combines the two categories that we have examined.

In recent years there have been interesting developments in street art which seek to exploit the idiosyncrasies of point of view perspective with dramatic effect. These anamorphic 3D paintings (exemplified by the work of Edgar Müller) actively challenge perception. Müller's work presents an absolutely compelling but obviously impossible 'reality' where even the introduction of real figures, objects and shadows (which should confound the illusion) do not disrupt the

[9] For Gibson, they simply provide definitive proof that visual perception is not the result of retinal stimulation – if it were, it would not be possible to see two images (Gibson, 1979:33)

'passive disengagement' of the viewer. In pictures taken from the intended ideal point of perspective, it is simply impossible to see the work as flat (see Figure 10 to Figure 12).

Figure 10. *Lava Burst*, Edgar Müller, Geldern, 2008 (Müller, 2016)

Figure 11. *Crevasse*, Edgar Müller, Dun Laoghaire, 2008 (Müller, 2016)

Figure 12. Even the introduction of real world objects does not disrupt the illusion. (Müller, 2016)

Wade's identification of the image as 'allusion' rather than representation (see page 65) is important in this context and of course it is a concept that has been frequently explored in the field of fine art, particularly in the work of the early Cubists and in the work of some of the Surrealists. The works of René Magritte

for example often provide an active challenge to the perceptions of the viewer. Here there is an explicit and often very effective attempt to disrupt 'passive disengagement' by presenting a contradiction so obvious that the brain simply cannot discard it. In order to reconcile the image, the viewer must make a conscious intellectual intervention without which the art is incomplete because the artwork is both a visual artefact and the replication of a thought process designed by the artist. This process of compounding image with conscious thought has obvious conceptual applications to the presentation of visualised research. Indeed it is possible that Thomas' experience with the *Marais* reconstruction might have been entirely avoided had he simply captioned it '*ceci n'est pas le Théâtre du Marais*' – though this may of course have impacted on the perception of the knowledge claims of that research.

So it is clear that we habitually regard visual material as definitive and that this is not simply as a result of the quality of the image but is rather a function of the way in which we process visual data. Seeing is a unconscious act and looking beyond that is often difficult, even with guidance. In order to begin to engage the user in a debate which is reliant on visual material, the researcher must follow Magritte's example and find ways to disrupt this process of 'passive disengagement' and 'activate' the end user.

Procedural Engagement with Visual Research

We have acknowledged that Nelson's conceptual model of practice as research offers some guidance to the ways in which we might consider the procedural engagement of the visual researcher but that its usefulness as a model is limited because of its focus on performance practice. It is also possible that Nelson's model fails to fully account for processes of reconstructive practice because of its reliance upon models of 'knowledge' that are derived from assumed hierarchies that are implicit in western epistemological traditions.

Consider for example the distinction the Nelson conceptual model makes between the art artefact, the commentary, and the embodied understanding of the researcher (Figure 2 above). Moments of 'haptic insight', cannot really be accounted for as 'know how' as the knowledge gained is not simply a knowledge of acquaintance (Russell, 1951) but constitutes an understanding beyond that.

In this sense it is necessary to conceive of knowledge and understanding as distinct. The skilled model maker may possess a range of embodied knowledge (know how/insider practitioner perspectives) but the practice of model making **as** research methodology also delivers an embodied **understanding** which moves beyond knowledge.

In Nelson's model, 'know how' exists as a tool – a tacit rather than explicit element of the research process - the artist has embodied knowledge that when applied to the research questions might render results by doing. This is static and rightly described as embodied 'knowledge'. But the process of modelling is procedural and dynamic, the embodied element is **realised** through process and remains fluid. The developed understanding remains tacit but it is not described nor communicated through the existence of the model (as with the artwork in Nelson's example) but **evidenced** by it.

While it is easy to think of modelling software as a tool for the visual researcher, it is perhaps more helpful to think of it as simulation environment in which the reconstructive researcher is provided with opportunities to develop and simulate visual hypotheses. The parameters of this simulation are not necessarily fixed by the medium, they can be designed by the researcher but the hypotheses must be accounted for in appropriately extended ways which support rigorous interrogation in 'modelled reality' (the use of the term 'virtual' in this context can be unhelpful as it suggests a representation of actual reality rather than a reality authored by the researcher and consequently makes implicit knowledge claims). Perhaps more importantly, the visual researcher must occupy this 'simulated' environment principally as a maker rather than a commentator, and this role significantly changes the relationship between the researcher and their evidence.

It might be useful here to consider an alternative view of the impact of 'doing' on knowledge and understanding. In his book *Making* (2013), Tim Ingold explores the concept of 'thinking through making'. Drawing together disciplines of anthropology, archaeology, art and architecture he presents an alternative view of embodied knowledge that moves beyond the assumption that that which is embodied by practice may be tacit, but must be discrete and quantifiable (as is suggested by Nelson) and suggests a more complex relationship between

maker and artefact. During early experiments, Ingold re-framed seminar discussions which addressed the interface between art, architecture and anthropology in the context of acts of making and doing (basket weaving, pottery, Alexander technique etc.) he found that the nature of the discussions was qualitatively different to anything that the group had experienced in the context of the seminar room and frequently produced 'tremendous new insights' into the topics under discussion (Ingold, 2013:9).

While he is not immediately able to articulate why this might be the case, he does present an interesting analysis of the apparent effect that acts of creation have on cognitive processes. For Ingold the difference lies in the understanding of things as materials rather than objects. The maker is not primarily concerned with the narrative of an object but its **potential**, 'in treating… erstwhile objects as materials we rescue them from the cul-de-sac into which they had been cast and restore them to the currents of life' (Ingold, 2013:19). Perhaps more importantly, he found that the consideration of potential is an iterative act where the construction of narrative is primarily reflective. For Ingold this fundamentally changes the way in which 'things' are received and his characterisation of the relationship between maker and material as 'correspondence' (rather than the more familiar 'interrogation') usefully captures the immediacy of the experience of the visual researcher.

Demonstration 2 – Making

You may start your Jigsaw now…

Consider your engagement with the puzzle. With jigsaws, we inevitably engage differently with the final image (even though we may have access to it at the outset). This is not simply a function of its fragmentation, but the puzzle is designed to cast us in the role of 'maker' and this places an active emphasis on the image as it must be decoded. It is not possible to simply interrogate the pieces, the initial focus of the 'maker' becomes in preparing a hypothesis (what is this an image of?), developing a cypher (how might I categorise colour/texture etc. in order to resolve this image?) and ordering the data in ways which prove the hypothesis in extended ways (where does this piece fit? It is indeed a picture of the Wren section but I also need to establish how and where it is framed in the overall image). So it is with modelling practice. The need for completion means that each piece of evidence takes on an imperative that may not be evident in other modes of research - this **is** part of the picture, it **must** be accounted for. Where does it go? How does it relate to other pieces? In this respect, the sliding puzzle included with the jigsaw is a better example as the body of elements is fixed and irreducible. The whole must be accounted for at all times.

The visual researcher who concerns themselves with making as methodology approaches evidence as material rather than object, and this distinction inflects both the ways in which evidence is deployed and the mode of the investigation. To treat evidence as material rather than object is to admit that even when distanced by time the relationship between artefacts and the history that they represent remains vital and dynamic.

Modes of Process

Miguel Sicart's work *Play Matters* (Sicart, 2014) explores the role of play in creative processes. He characterises play as a form of understanding; "play is a portable theory… It is not tied to objects but brought by people to … complex interrelations" (Sicart, 2014:4). He identifies in the computer a powerful tool for a particular kind of play. Since computers function as systems in action, they excel in play which seeks to establish, challenge and adapt rules – which accounts for the centrality of modes of simulation in modern computer gaming.

To understand computer modelling practice as a form of simulation in modelled reality is to accept that the rules of that reality are not fixed. Just as the 'maker' of the jigsaw must develop a cypher, so the visual researcher must design the rules of their simulation. While this does of course contribute to methodological concerns, there are distinct 'modes' in which the researcher may work and this choice has an inevitable impact on the way in which they engage with their materials.

In the 1954 *Marais* reconstruction we have identified a mode of literary reconstruction which we might broadly term 'linguistic' reconstruction. In this mode, analysis of both visual and non visual material is essentially verbal, and the presentation of the outcomes of such analysis is presented as narrative with illustrations. This form of reconstruction is most clearly demonstrated in Golder's critique of the work of Deirkauf-Holsboer, but the concerns about authority lent by illustration were also the driving force behind archaeology's attempts to regulate acts of reconstruction. Since the analysis in this form of reconstruction is principally linguistic, engagement with the material is primarily verbal in nature. This mode of reconstruction is reliant on description and interrogation and inevitably tends to treat evidence as objects fixed within a narrative which is 'revealed' by the researcher. This mode of reconstruction is subject to a number

of issues which the researcher must guard against. Most significantly, this is a mode in which it is relatively easy for the researcher to accept incomplete or untested hypotheses and while this is not necessary problematic, it is the foundation of much of the criticism aimed at reconstructive research.

Conversely, work carried out by Favro, THEATRON and the Drury Lane and Italian Renaissance projects described above engaged with a mode of reconstruction which relies on a close analysis of extant plans and survey material. In this 'technical' mode of reconstruction, engagement with source material is primarily spatial in nature. In truth, the 'technical' mode occupies a spectrum rather than a position, based on the extent and security of the source materials available. In the case of projects where there is a reasonably complete set of materials and consequently little need for conjecture (such as the *Teatro Olimpico* at Vicenza and Holland's Theatre Royal Drury Lane) the modelling environment provides an appropriately 'real' environment for reproduction. In projects were the data set is incomplete (as with Wren's Drury Lane Theatre) or ambiguous (as with Sabbioneta) however, this mode of reconstruction provides a particularly valuable environment in which the researcher may develop and evaluate hypotheses. Evidence is genuinely treated as material and the researcher has the opportunity to 'correspond' with source material in a process which is more iterative dialogue than narrative.

The third mode is both the most problematic in the terms of the archaeological charters and the most useful where material does not lend itself to spatial interrogation. This is a mode of reconstruction that we might broadly term 'visual'. This mode is exemplified in Hann's work on Meyerhold's 1926 production of *The Government Inspector* (Hann, 2010a) and Fergusson's work on Appia's unrealised designs for Wagner's *Ring Cycle* (Fergusson, 1998) and Vlastislav Hofman's 1926 design for *Hamlet* (Fergusson, 2016). This is a mode that may be deployed where there exists no evidence that might be described as of a technical nature (plans models etc.) but aims to develop an extended sense of space from two dimensional images. This form of reconstruction uses visual material to establish an implied (or in the case of photographs, actual) point of view and interpolate spatial information by constructing a three dimensional virtual model which corresponds to available two dimensional renderings. In this

mode, engagement with material through interpolation could (in a strictly mathematical sense) be described as ‘methodical’, though the term ‘holistic’ better captures the true nature of this engagement. Both Hann and Fergusson have used this mode to develop reconstructive practice which aims to place a primary focus on the intentions of the artist rather than the reality of the stage space. In this mode, evidence is again treated as material but the extended requirements of interpretation (particularly in the case of the Hofman design) mean a greater emphasis on the original design process through attempts at re-enactment. In this respect, this ‘visual’ mode of reconstruction has a clear focus on the reconstruction of **process**. In the case of the Hofman reconstruction this mode was used to explore the relationship between the artefacts of the design process and the notional spaces that they were intended to represent in the context of the designer’s developing conception of the production.

Hofman’s work on this project is documented in an unusually complete set of design artefacts from initial ‘concept’ designs through storyboard and scenic model to final production photographs. What is perhaps unhelpful to the visual researcher on this project is that Hofman adopted radically different stylistic approaches at various points in the process and this greatly complicates any attempt to capture a sense of Hofman’s conceptual development through comparison. Actual differences in the spaces implied by the various design artefacts are obscured by our tendency to interpret stylistic difference (through the application of conceptual constancy). In this case, a process of visual reconstruction enables the researcher to both interpolate the staging implied by the designs and reject stylistic difference by applying a uniform visual style.

This project revealed a process in which the designer was clearly interrogating the use of both Expressionist and ‘Purist’ (Hofman’s term) aesthetics with a view to resolving a tension in his design concept (Fergusson, 2017). The reconstructed process shows an initial design with clear statement of Cubo-Expressionist intent, first tamed (in the storyboard) and then removed (in the model box) before being re-instated (in the production photographs) in a way which represents a pragmatic compromise between the designer’s intent and the technical requirements of stage realisation.

Both the Drury Lane project and the Hofman project required the development of more flexible approaches to the use of 3D modelling tools. Generally speaking, softwares such as 3DS Max have been developed as tools for creating a complete or final image, and developers invest a significant amount of time and energy into improving their lighting and rendering engines. Many of the case studies in this project have required that the visual researcher engage with the software in ways which are more aligned to sketching or prototyping and this does require them to adapt their use of the tools that the modelling environment offers. This raises issues of expertise.

While I have advocated the use of modelmaking as methodology for the visual researcher, it is important to acknowledge that facility with this tool is by no means easily achieved and indeed that the experience of the novice model maker is certainly radically different to the experience of the expert model maker. It is one of the aims of this study to demonstrate that the development of this expertise is well worth the effort. Polanyi's work on tacit knowledge (Polanyi, 1967) also address experiences which we would (in Nelson's terms) conceive of as 'embodied' when he draws upon the experience of tool users. He explains the incommunicable nature of tacit knowledge by identifying that it exists in the relationship between two sets of phenomena, one external (distal) and one internal (proximal). Since we never experience ourselves as an object, we are able to qualify the distal element but not the proximal one. So I am able to describe your eyes, nose, mouth etc. (distal) but I cannot tell you how I recognise your face (proximal).

When Polanyi turns to tool users, he draws upon the example of a blind person using a stick to sense their environment, but the experience that he describes, relates equally to a woodworker and their chisel or a driver and their car. In his example, the blind person first interprets the world through the sensations in their hand and conceives of the stick as part of the world to be sensed. But with use and developed expertise, the blind person comes to conceive of the stick as an extension of themselves (through a process that he terms 'indwelling')

and the environment as the world beyond the stick[10]. Now the 'indwelt' tool becomes part of the proximal phenomenon, and our 'embodied' understanding of the tool tacit, and beyond communication. It is perhaps paradoxical that Polanyi's notion of indwelling means that it is likely that the more expert the model maker, the more profound these difficulties of communication become, but this is the result of 'indwelling' in the tools offered by the modelling environment.

Understanding the computer model making environment as a tool in this context goes some way to understanding the profound difficulties experienced by visual researchers in communicating the precise nature of their insights.

Issues of Communication

Models and Metaphors

We have noted Reddy's view that the conduit metaphor shapes our understanding of language. In *Metaphors We Live By* (2003), Lakoff and Johnson significantly extend this argument. In their view, it is not just our language about language that shapes our conceptual understanding in this way, but our language about everything. They suggest that human thought processes in general are largely metaphorical and argue that metaphorical imagination' is a crucial skill in both communicating unshared experience (231) and for "understanding partially what cannot be understood totally" (193). Indeed they suggest that metaphor may be the **only** way to coherently organise those aspects of our experience.

The implications of this are significant. As we have seen, the existence of metaphor in Reddy's example leads to a profound 'frame conflict' which prevents our understanding of communication in any other terms than those which suggests that clear communication requires little or no effort. In Lakoff and Johnson's terms that "In allowing us to focus on one aspect of a concept…

[10] This phenomenon might be familiar to a driver who experiences the physical sensation of potential impact during a near miss accident – as though the nearside wing of their car was an extension of their sense of self.

metaphors can keep us from focussing on other aspects of the concept that are inconsistent with that metaphor" (Lakoff & Johnson, 2003:10)

The value of metaphors in this concept is that if we practice 'paradigm-awareness' (as with the example of the 'Magritte' *Marais* above) they offer opportunities for us to develop ways of focussing objective engagement with visual research on concepts which were of crucial importance during procedural engagement, thus bridging some of the gaps experienced between the visual researcher and end user.

The importance of Magritte's work here is obviously only conceptual. It demonstrates the possibility of disrupting 'passive disengagement' and of designing visual material that replicates thought processes. As a practical example for how this might actually provide conceptual models for the visual researcher, it is less useful. The ambiguities explored in Magritte's work exist as tools to challenge the preconceptions of the viewer. The visual researcher on the other hand needs to present ambiguities that genuinely allow the viewer to evaluate and compare alternative interpretations of evidence – to design a form of ambiguity which suggests the possibility of multiple alternative states of being. While the material may seem only tangentially useful and with little practical application, it is worth at this stage exploring some other conceptual analogues offered by fine art.

The work of the Cubists (particularly the Salon Cubists, 1912-1914) sought to make a visual representation not just of space but also of time and of alternate points of view. The works of Jean Metzinger and Albert Gleizes present an apparently fragmented view of the world in which alternative points of view coexist with the presentation of time as a continuum in which there is no meaningful distinction between past, present and future. This concept of 'simultaneity' challenges the notion of separate spatial and temporal dimensions (aligning them with the position proposed by Einstein in 1905 in what is now known as his Special Theory of Relativity) and attempts to present a four dimensional reality with no fixed point of view in which the viewer may 'author' their own experience of the subject (Figure 13).

Figure 13. *Harvest Threshing*, (Gleizes, 1912)

Metzinger and Gleizes' critical work suggested that this new style was driven by concerns that fine art tended to suggest the existence of definitive realities and that this approach was rendered suspect by the peculiarities of the act of perception – their description of which might be closely identified with the position taken by modern psychology:

> Gustave Courbet […] inaugurated a yearning for realism which is felt in all modern work. However he remained a slave to the worst visual conventions […] he accepted without the slightest intellectual control everything his retina communicated. He did not suspect that the visible world only becomes the real world by the operation of thought, and that the objects which strike us with the greatest force are not always those whose existence is richest in plastic truths. ('Cubism', Gleizes and Metzinger 1912, reproduced in Harrison & Wood, 1992:188)

Or more succinctly "an object has not one absolute form, it has several; it has as many as there are planes in the domain of meaning" (Harrison & Wood,

1992:194). The concept of 'simultaneity' was designed to allow the artist to explore and juxtapose these multiple forms.

So it was the intention of the Salon Cubists to deny the existence of absolute reality. Their art did not eschew the concept of reality *per se* but did reject the manifestation of 'superficial reality' in favour of the artist's exploration of a more subjective 'profound reality'. Their style was designed to generate an experiential rather than a phenomenological response in the viewer. John Berger characterises this work as being entirely different from more traditional forms of representative art in that it was concerned explicitly with that which is not self evident:

> The metaphorical model of Cubism is the diagram: The diagram being a visible symbolic representation of invisible processes, forces, structures. A diagram need not eschew certain aspects of appearance but these too will be treated as signs not as imitations or recreations. (Berger & Dyer, 2002:84)

Berger's metaphor is a useful one and of significant conceptual value to the visual researcher. To conceive of the output of reconstructive research as visual 'diagram' rather than visualisation is to privilege conception over perception and this clearly offers a potential opportunity to 'activate' the user.

Beyond this, the Salon Cubists also offer us something of more immediate value. As with Magritte, the attempt to engage the user in intellectual processes which relate to the exploration of their own perception is conceptually useful, but the Cubist attempt to express Einstein's model of space-time has more practical value, since it provides an analogue to the problems faced by the visual researcher, and by corollary there is the possibility that attempts to visualise space-time might also propose **practical** solutions to these problems.

Space-time as it is understood by modern physics is by its nature inconceivable. The suggestion that we live in a dimensional structure that exists beyond the limits of our own perception is obviously a significant barrier to our ability to conceive and model such a structure. Any attempts to model the possibility that time may exist as a dimension like any other (or at least like the three that we are more aware of) are confounded by our compelling perception of time as segmented and transient. Theoretical physics then is presented with two sets of

problems, computational difficulties (which we can safely discard) and those problems which relate to the communication of theoretical concepts which underpin this work. The theories of space-time suggest that time exists as a continuum and that concepts such as before and after are meaningless – or at least are as subjective as terms such as left and right – and this makes simultaneity (or at least something that we would perceive as simultaneity) a significant feature of modelled space-time. The analogue with visual research is that both fields seek to present parallel possibilities in such a way as to allow the viewer to engage conceptually with ambiguity and contradiction.

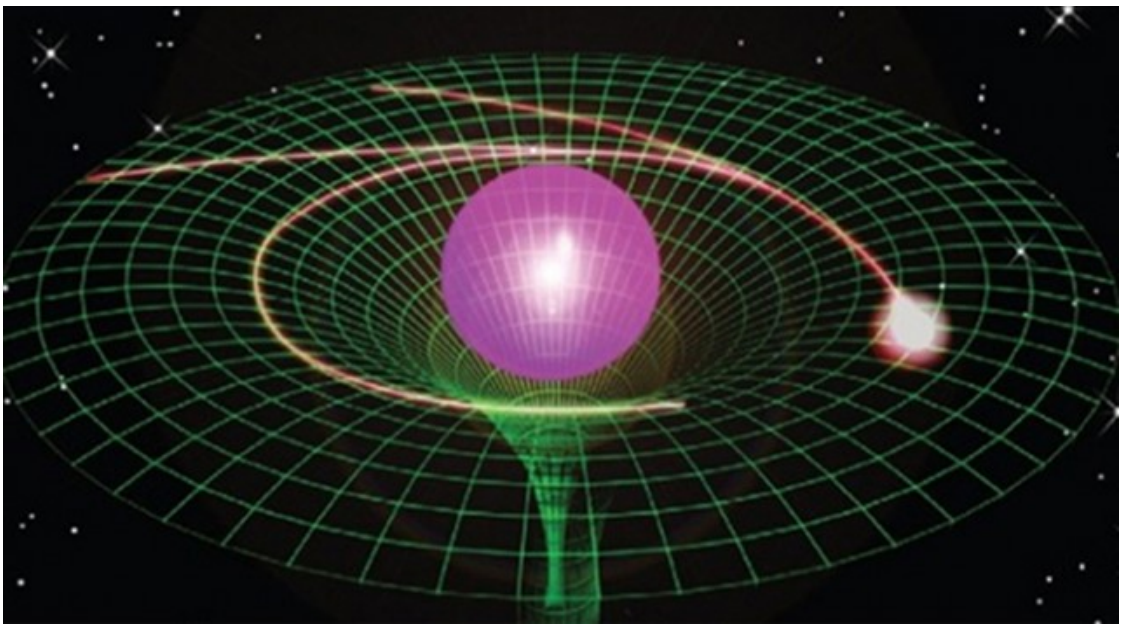


Figure 14. Gravity explained as flexible space-time (Discover the Space 2017)

The approach of theoretical physics has been to adapt models that are less conceptually problematic and use those ideas in which we have confidence as metaphors for ideas which inevitably have to remain ‘fluid’. As an example we might look at Einstein’s own (relatively unambiguous) model of space-time in which space is presented as a ‘rubber’ sheet that is deformed by those massive objects that occupy it. The deformation here demonstrates the way in which gravity relates to mass (Figure 14).

The metaphor operates in two different ways. First, it relies on our ability to conceive of a two dimensional space (the sheet) and then it substitutes the third dimension (in this illustration, height) for the concept of gravity. This doesn’t need to be explained because second, our experience of the world means that

we already understand that round things roll downhill. So we can understand that the more massive the object, the greater the gravity effect caused by the deformation of space-time and the greater its effect on passing objects. It seems straightforward but if we try to reintroduce the missing dimension that we discarded, our conceptual confidence is lost. The metaphor here allows us to grasp a concept that we can never hope to fully understand because the limitations of our perception prevent us from seeing the situation as it really is. It also allows us to focus on that aspect of the concept of space-time which most closely relates to our own observational experience (gravity). The presentation of this visual/conceptual metaphor is supported by an embodied understanding based on our own experience of the world. In order to identify this kind of diagram, I will term it an 'experiential metaphor'

The extension of this effect that is used to demonstrate the 'gravity well' that is described by the action of a black hole – where even light and by extension, time cannot escape the pull of gravity (Figure 15) – produces an image of space-time which is apparently tubular. This model has been adapted by physicists to provide what is arguably a more accessible metaphor for subjectivity in time than Einstein's own example of the space travelling twins[11].

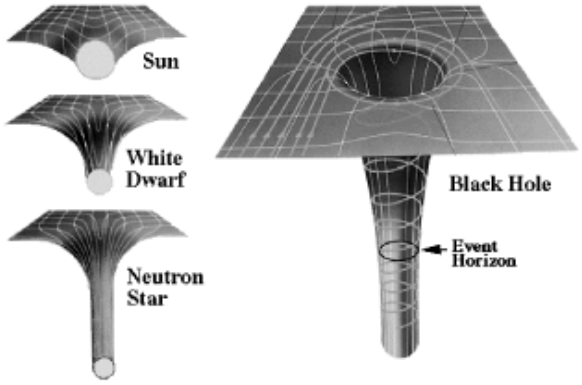


Figure 15. The 'gravity well' caused by a black hole (Discover the Space 2017).

[11] The 'twin paradox' demonstrates the principal of 'time dilation'. In this thought experiment one twin travels through space at high speed while the other remains on earth. On the twin's return he finds that his brother has apparently aged more. The twins' perception of time is different because of the influences of speed and gravity on their respective observational points of view.

In this model, time and events are presented as a tube – indeed it is a better example if one physically uses a tube. Our accepted (and limited) perception of time is suggested by our understanding that the tube is also a tunnel. Really though this is another example of substituting one dimension with another – here the length of the tube actually represents the 'passage' of time. The key to the metaphor though is that the observer is placed outside of this system so that while the inside of the tube represents two dimensional space plus time, the outside of the tube is restored to our understanding of a three dimensional space around which the observer may freely move.

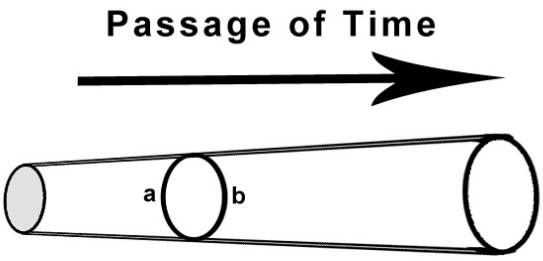


Figure 16. Observer 1

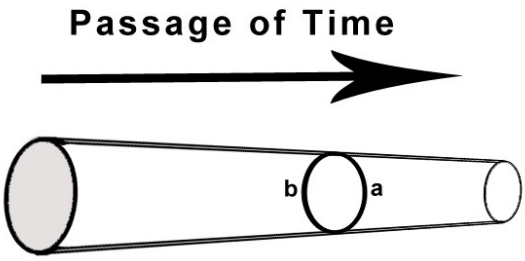


Figure 17. Observer 2

When liberated from the linear view prescribed for the observer within the tunnel, it is clear that notions of sequence are entirely dependent on point of view (and that time is simply an extension of space). In Figure 16 we see that from observer one's point of view, event 'a' clearly happens before event 'b' while for observer two (at the other end of the tube in Figure 17) the order is reversed. For the observer in the tunnel however, events 'a' and 'b' can only happen simultaneously. The modelling of this reading of space-time is reliant on the user's understanding that the tube may be reoriented for an alternative outcome and the metaphor allows us to focus on those aspects of space time which relate to causality and point of view (we understand the concept by effecting a change external to the system).

This is of course not the only model of time proposed by physics. An alternative reading of space-time (proposed by Herman Minkowski in 1908) removes the observer from the model in order to propose that while **our** perception of time may suggest patterns of order and causation, a purely objective view of space-

time suggests that all events are in fact fixed. This 'Block Universe' theory has been adopted by predeterminists to prove that free will is a purely subjective illusion.

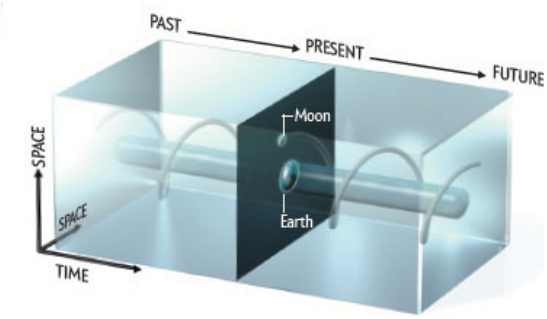


Figure 18. Moon orbit as observed as a progression of presents (in Davis, 2012)

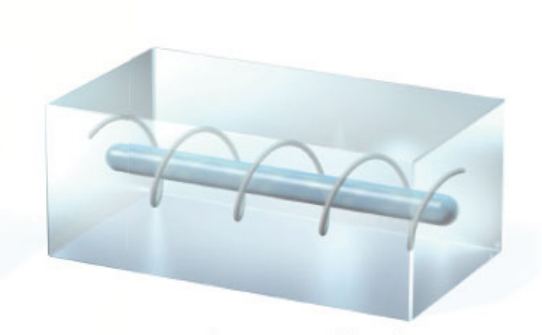


Figure 19. Block universe presentation of moon orbit (in Davis, 2012)

Again, the Minkowski model[12] relies on the substitution of time for one of the physical dimensions. As with the point of view model (above) the viewer is required to 'imagine' the experience of the observer within the model and then interpolate this into a wider context. It can be closely linked to the view of dimensional perception presented in Edwin Abbott's 1884 book *Flatland: A Romance of Many Dimensions* (Abbott, 1884) which explores the characteristics of a two dimensional reality and the difficulties experienced on the arrival of three dimensional 'characters'. The Minkowski model presents space-time as perceived by an observer with our mode of perception, as a series of slices each representing the current 'present' with past behind and future ahead (Figure 18). Again, this is a model which needs little explanation as we have an understanding of the illusion of movement produced by a flick book. As Abbott's work required the observer to imagine three dimensional objects as 'slices' in two dimensional space so the Minkowski model requires the user to 'reassemble' individual slices into a three dimensional model (Figure 19) in which the appearance of three dimensional objects is an analogue for a fixed four dimensional space-time. This metaphor differs from the 'tube' model as it allows us to focus instead on the way in which a four dimensional observer might 'see' our reality. In this case, the moon is represented by an object that does not

[12] Minkowski's proof of theory was in fact entirely mathematical and contained diagrams only in the form of graphs. Visualisations were developed by later commentators.

resemble a moon in any conventional sense (the corkscrew) but in a way which makes that manifestation relatable to our own existence.

As with the ‘point of view’ model of space-time, the presentation of this visual/conceptual metaphor is supported by an understanding based on our familiarity with real world objects. In order to identify this kind of diagram, I will term it an ‘object metaphor’.

The final class of metaphors that I will look at relate to presentations of difficult conceptual modelling used in the field of quantum physics. Here, researchers are faced with different forms of ambiguity than those presented to the broader study of Special Relativity. It is clear that our conception of the laws of physics often operate differently on a quantum scale than they do on a universal scale and most physicists accept that this indicates that our understanding of these laws is simply incomplete. Our universal laws are an extremely good approximation of the action of physics and render accurate results, but they do not necessarily work when applied at a quantum level. This does not mean that the laws cannot be modelled, it does however mean that the models need to be more flexible. As the name suggests, renormalisation (or coarse graining) resamples data as the user changes the scale of their view, adjusting the expectations of the image as the user widens their scope. The example below (Figure 20) shows the process of renormalisation in an ‘Ising Model’ (which deals with magnetism in ferrous metal). Figure 20a shows the pattern and distribution of polarity markers in a section of the sample. Simply zooming out would ultimately render this data unreadable, the process of renormalisation resamples the data in larger groups (Figure 20b) then reassigns data based on the dominant characteristics of the group (Figure 20c) providing an approximated value which may still be accessed as the scale of the model is reduced. This process can be repeated iteratively as the scale is reduced, this ensures that each new set of values approximate the previous set of values within limits that are appropriate to their scale.

The final diagrammatic example relates to the possibility of modelling with unknowns (rather than simply with unknowables as in Special Relativity). It is possible in quantum physics to be dealing with systems in which there are unknown elements that do not disrupt the possibility of understanding the

system as a whole[13]. In such cases it is common practice to simply represent the unknown process or element with a black box as a placeholder.

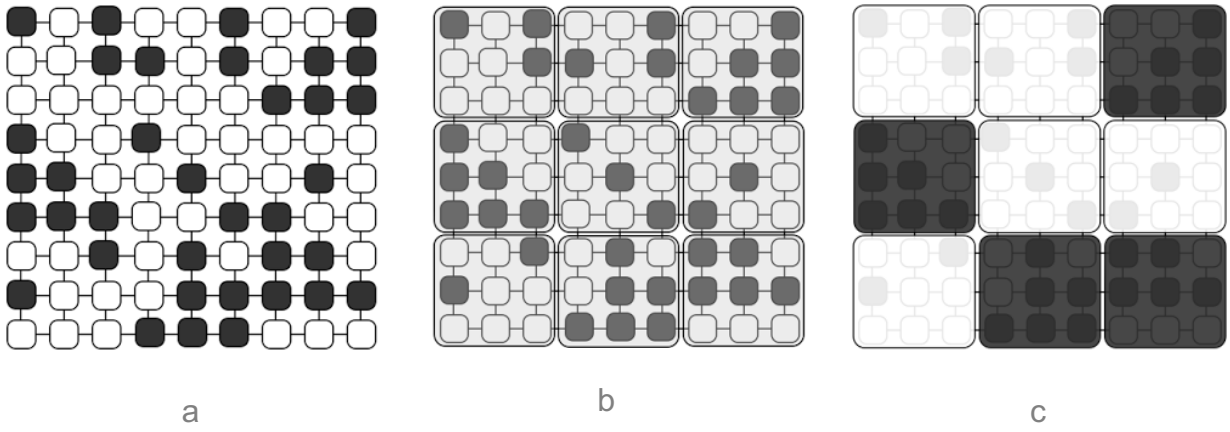


Figure 20. Ising model with renormalisation (in Ashton, 2012)

In both of these examples, the presentation of the visual/conceptual metaphor is supported by an understanding that elements of the model are not a representation of reality but simply a placeholder for it. In order to identify this kind of diagram, I will term it a 'proxy metaphor'. These metaphors focus on preserving 'essential' information and allow us to conceive of complex systems in simplified ways. In the Ising model, the bottom right hand block isn't black, but if we think of it in that way then we can continue to deal with the data in totality. Something happens in the black box but we don't actually need to know what it is.

Summary

In this chapter, I have developed a set of alternative narratives which explore modes of conceptual engagement with issues of importance to the visual researcher. Problems identified by the likes of Favro, Hann and Baker which relate to the importance of process, issues of transparency and perception of the state of knowledge concept have been reframed as three separate sets of phenomena; procedural engagement with visual research; objective engagement with visual research; and issues of communication. I have explored the profound differences between the experience of the visual researcher and

[13] Indeed, the popular thought experiment demonstrated by Schrodinger's Cat illustrates the inevitability of these 'unknowns'.

that of the end user and have suggested that there exist in metaphors the possibility for bridging these kinds of conceptual gaps.

Reddy's concepts of "paradigm awareness" and "frame block" suggest that we should explore the nature of the discipline (and the ways in which we think about it) to ensure that we are not engaged in paradigms that prevent us from examining these issues in productive ways.

The virtual model is a metaphor. The user (both procedural and objective) does not inhabit the space, the objects presented are not real and any sense of causality experienced in virtual space is a product of programming. While the virtual often references reality (though this is not a necessary condition of virtual environments) the relationship between real and modelled space **is** metaphorical. As with Einstein's models of space-time, this is an experiential metaphor and it encourages us to focus on aspects of the virtual which suggest that it is conceptually the same as the real. But its resemblance to reality (reinforced by the language we use) obscures its metaphorical nature, and this disrupts attempts to discuss its modality. This is a form of frame conflict.

Our attitudes to VR tend to function in similar ways to the conduit metaphor – the 'powerful visual and kinetic experience' references perceived reality closely enough to suggest that communication in this form works automatically. But Reddy's toolmakers paradigm demonstrates that without constant maintenance of a shared understanding of metaphors by those involved in the transaction, the communication of information becomes impossible.

Schön and Reddy both identify metaphors which shape our conceptual understanding of issues as 'generative' metaphors (though Lackoff and Davis claim that **all** metaphors work in this way). Because the experience of making offers unique insights, the maker and the user inevitably have a very different understanding of the metaphor of virtual space, and it is likely that the tacit nature of this understanding renders it difficult to communicate.

Viewed through the lens of the frameworks offered by Gibson, Ingold and Reddy we can begin to see how habitual modes of thought dominant in the field of visual research have led to the formation of a compelling frame conflict in which the model is an obvious and ideal vehicle for communication between the

researcher and the reader. But this view is reliant on assumptions that fix the nature of the model and align process with knowledge. Once we accept that the model is not a ‘thing’ but a metaphor, it is clear that it ‘means’ very differently for the researcher and the reader. At best this means that they are engaging with separate and very different generative metaphors, and by extension different conceptual models. More likely though, this represents a frame conflict which actively prevents meaningful communication between them, because in order for communication to function effectively there must be a shared understanding of metaphors by those involved in the transaction.

It follows then that in order to establish effective modes of communication in visual research, the dissemination of that research must include acts of structured authorship that acknowledge the nature of this frame conflict and seek to establish productive metaphors which can be shared with the reader and are are subject to negotiation and maintenance.

Conclusions

Authoring the User Experience

I have attempted here to develop a conceptual framework which might be used to both analyse existing approaches to the presentation of visualised research and to develop new approaches. As Baker has noted, the **process** of the visual researcher is a discrete output of visualised research and needs to be thought of as such, but the approaches that the field has adopted to this have not always been effective. Notions relating to the user's ability to access paradata are important but they really only address one of the questions raised by Baker's assertion. The action of perception, the mode in which the user experiences outputs and the nature of diagrammatic metaphors are all important aspects of designing the user experience and communicating the findings of visualised research, but simple authorship cannot really duplicate the tacit or embodied understanding generated by procedural engagement with methodologies based on digital reconstructive practice.

The possibility of authoring not only the visual experience but also attempting to design the user's thought process offers significant potential to the researcher who aims to communicate part of this experience and it is clear that in order to achieve this we must develop a greater understanding of the ways in which the user perceives and understands the material that we present. The assumption that the user is automatically engaged by notions of interactivity is naïve, the birth of this reader cannot simply be ransomed by the death of the author because processes of communication are not automatic, they are negotiated. In order to fully engage with the outcomes of visualised research the user requires access not only to the voice of the researcher but also to their experience, and this cannot be achieved by simple adherence to process guidelines.

Embodied knowledge can really only be communicated by doing. During this study you have engaged in a number of demonstrations (there are more to come) which make this clear. While it is not realistic to assume that it is possible to guide the 'reader' of visualised research through repeating the process of the researcher sitting at the computer, it is possible to devise modes of presentation where the use of metaphors can help to guide the actions of the 'reader' in ways

which focus on those aspects of the experience of the researcher which best communicate their insights.

Hann's proposed media rich, context sensitive VR models are one such metaphor. The user is free to explore, but proximity to a reconstructed artefact triggers a presentation of metadata and paradata relating to its creation. In this 'proxy metaphor', each object is the sum of the choices that made it and the user is encouraged to focus on the act of reconstruction. For a researcher wishing to communicate the importance of choices and expose the processes of reconstruction, it is an extremely effective metaphor but this does not make it an ideal solution where the researcher wishes to communicate different findings.

In order to design appropriate metaphors for communicating their findings, the visual researcher needs to first know what their findings are. This might seem axiomatic but that is only because we are familiar with the ways in which we construct written arguments in which structural choices are not arbitrary. But this is not generally speaking the way in which we engage with the presentation of visualised research. We present images, videos or even interactive models but these do not offer any real opportunities for authorship. We may offer a point of view, we may even offer a choice of points of view[1], but this does not mirror the flexibility with which we communicate in scholarly writing.

I have in this study considered the function of visual perception and suggested a value in metaphor, but I have so far avoided the subject of the experience of the end user. This study did not aim to conduct empirical research on human subjects – and, in truth the material that I have presented here suggests that such an approach would not be entirely helpful. Nevertheless, there is one aspect of the user experience that is essential to this discussion and that relates to questions of time.

So before returning to more practical concerns I would like to consider one more 'diagrammatic' presentation of ambiguity. Interestingly, although it is an example from physics/philosophy it is a concept that has been subject to very little visual modelling. Many Worlds theory (or the 'multiverse') is closely linked to concepts

[1] THEATRON offered the user the choice to experience each theatre as a point to point guided tour.

proposed by the Schrodinger's Cat thought experiment and proposes that there exist an infinite number of parallel universes, each distinguished by the outcome of choices which represent branching points at which divergent realities are created[2]. Generally speaking, this concept has been demonstrated by a simple branching tree diagram (after all, what more is there to say). Where the concept has received rather more popular consideration though is in literary and screen fiction where the consequences of choices deliver significant dramatic potential. The concept of the time traveller's paradox is commonplace in science fiction and from *Back to the Future* (1985) to *Sliding Doors* (1998) and to *Harry Potter* (2004a) the complexities of alternate outcomes are treated in similar ways: The narrative identifies a moment of critical choice and the potential narrative outcomes of that choice are developed either in parallel (*Sliding Doors*) or series (*Back to the Future*).

Though this is clearly not a metaphor, it is still a diagrammatic exploration of ambiguity and as such still engages the viewer in a critical thought process. Where this example differs from the three classes of visual metaphor explored earlier (experiential, object and proxy) is that this model can only exist in time. That is, it cannot be viewed as a static diagram but demonstrates a developing or unfolding model. In the case of *Sliding Doors* or *Back to the Future*, the experience (the narrative) is authored, but there are also examples where (as in Gleizes' *Harvest Threshing*) the viewer is given the freedom to author their own experience of the subject. Modern computer based Role Playing Games (RPGs) are an obvious example, but in the interest of preserving the game experience, the extent to which the consequences of choices impact the narrative is often ambiguous. A more useful example in this context might lie in the Fighting Fantasy book series which launched with *The Warlock of Firetop Mountain* (Jackson et al., 1982). These 'gamebooks' relate a narrative which is dictated to a significant extent by the reader who is presented with a series of

[2] So while Schrodinger proposes that the cat exists in both states until the quantum wave function is collapsed (resolving the fate of the cat). Many Worlds theory suggests that the cat's state is not really resolved - it continues to exist in both states but the collapse of the wave function dictates which reality the observer occupies. Though there are of course now two observers, one in each reality.

choices, each of which represents a branching of narrative into alternate possibilities. While this represents a ‘diagram’ which is similar to the ‘sliding doors’ model it differs significantly in the authorial input of the user. Both models exist in time but the characteristics of this time differ in intention and effect. In the example of the Fighting Fantasy book, the operation of time on the model is distinctly interrogative, while the *Sliding Doors* model operates in a discursive mode of time.

Of course while it is most apparent in the development of narrative, in truth, none of the models that we have looked at so far can operate outside of time. In its reliance on intellectual engagement, each model, even those derived from static diagrams, has to be regarded as an unfolding model. In this regard, the concepts of ‘discursive time’ and ‘interrogative time’ become important to the researcher who aims to design an experiential engagement with the outcomes of visual research.

Demonstration 3 – What Time is it?

The choice of interrogative or discursive modes of metaphor is important to the ways in which we author the presentation of our material, and the ways in which the user constructs their understanding of our research.

The Theatre Royal Drury Lane reconstruction offers an example of this principle in action. On the website, visit the ‘process’ section of the 1674 Wren Drury Lane. Open the ‘ground plan’ page.

Compare this to the presentation of the same material as an interrogative demonstration. Visit the ‘outputs’ section and open the ‘interactive demonstration’.

The process by which the ground plan was interpolated is presented first as a ‘discursive’ video and then as an ‘interrogative’ game. In the chapter ‘Drury Lane, the English Model’ it is also presented as a written narrative. Consider the different ways in which you come to understand that process. Is your attitude to the knowledge claims changed by engaging in a process which mirrors that of the visual researcher?

We should then consider the extent to which user choice is important to the metaphors that we author. The example of Hann’s proposition above is not just a ‘proxy metaphor’ it is an ‘interrogative proxy metaphor’, and in its reliance on causality (the user has to do something and observe the outcome) it further focusses on those elements of the metaphor which relate to process. Again, this is ideal in Hann’s proposition but not necessarily appropriate if the aim is to communicate a sense of narrative or propositional argument. THEATRON aimed to blend the two modes but the extent to which we encourage a sense of

interaction should be regarded as an act of **authorship** and not simply expediency based on the mode of delivery.

While equally subject to problems associated with the presentation of visual material, researchers wishing to focus on archiving the processes of reconstructive practice face additional challenges. The contributions of the process outcome often relate more closely to developed understanding than to knowledge claims and as such tend to be rather more personal to the visual researcher. Once again, strategies that might superficially appear to be effective are confounded by the existence of a paradox.

If we are to accept Baker's position that the process must be considered as a discrete outcome of reconstructive research then it is clear that this process must be captured as it happens. This position however would assume that the 'process' is clearly articulated at the point of capture. That is, that the impact and significance of the researcher's work is clear **before** the completion of the process. This is of course not the case. The 'revelations' of reconstructive research are often unexpected and sometimes only truly significant in retrospect. Here, our paradox might rest on a semantic confusion. While a reconstructive researcher must approach their task with a clear sense of methodology, the 'process' by which understanding is generated may only become clear once it is completed, because it is not a single body of material but a trajectory. The various activities undertaken by the reconstructive researcher (their 'practice') may all contribute to the final visualisation but they need not all contribute to the 'process' as discrete outcome. Or at least, the extent of their contribution to that process is not fully known until the researcher is able to reflect on their work.

There are two clear implications here. First, the mode of recording 'practice' must necessarily differ from the mode of presenting 'process', and second, that the mode of presentation must contain a strong sense of 'authorship'.

To date, attempts to present process have focussed on the concept of 'paradata' and have been principally directed at concerns over transparency and accessibility because in the words of *The London Charter*, it is essential that "computer-based visualisation processes and outcomes can be properly understood and evaluated by users" (Dennard, 2009). The focus though has

tended to be on the place of the computer visualisation as part of an on-going body of knowledge, rather than on the process as discrete outcome. This position tacitly privileges the final model as principal outcome in which choices must be made manifest. But the process and the model outcome are not the same thing. It seems odd then that so much enquiry has been directed into finding ways to combine the two, or more precisely, finding ways of adapting the latter to accommodate the former.

Of course this need not be the case, indeed once one accepts the importance of process **as** outcome, it is clearly a rather poor compromise. The process is a trajectory, the model outcome an artefact, they cannot possibly be equally served by a single mode of presentation. To put it another way, the process is the argument, the model the conclusion. They must be authored in different ways.

A more organic solution to the problem might be to locate the exploration of paradata separately in a presentation of the process, not in the presentation of the model. This offers a number of advantages. It enables the researcher to locate paradata in the context in which choices were made rather than simply demonstrating their impact on the final model. This gives the researcher the possibility of presenting much more sophisticated models of process in which they might show the significantly more complex interplay of choices and dependencies which generally characterises reconstructive research. Perhaps most significantly though it generates more possibilities for the presentation of rejected hypotheses rather than focussing only on those elements that are ultimately retained.

Proposals

As noted in the overview, proposals presented here are offered as paradigmatic approaches for the visual researcher rather than a toolbox of developed strategies but it is possible to draw some clear conclusions from this discussion. It seems that in order to appropriately present both process **and** final model, it would be necessary to produce two outcomes, each of which could focus on a different aspect of the research.

Metaphors of Process

The researcher would need to capture and archive all of their practice but ‘metaphors of process’ would need to identify those parts of the researcher’s practice which constitute the trajectory of the process, and articulate those in such a way as to make their value to the developed understanding of the researcher manifest and accessible. Because of the personal, experiential nature of this kind of outcome, we might suppose that it lends itself to ‘discursive’ rather than ‘interrogative’ modes (which by extension are particularly useful in the presentation of final models). Metaphors developed in this mode must focus on the ways in which material is presented in time and is likely to feature a developing sense of ‘narrative’. These metaphors might also tend to focus on moments of choice rather than taking a more holistic view.

The importance of developed ’narrative’ in metaphors of process means that approaches developed from cinematic approaches to Many Worlds theory (here termed the ‘sliding doors’ paradigm) might be particularly appropriate. Presentations of process which identify crucial branching points could develop arguments which explore the implications and outcomes of individual choices either in parallel or in series. Rejected lines of enquiry could be explored to the point of rejection and retraced rather than simply discarded. Metaphorical models built on the Sliding Door paradigm are likely to take the form of discursive animated sequences in which moments of choice are either presented in detail or cause a hiatus in the discourse in order for the user to make a more interrogative moment of engagement with the evidence (metadata) guided by the judgements of the researcher (paradata). These more interrogative moments might draw on approaches drawn from the ‘visual paradigms’ (below). This addition of the possibility of adding interrogative moments into the narrative also suggests the potential deployment of models developed from the Fighting Fantasy books (here termed the ‘gamebook’ paradigm). Just as for the researcher the process of reconstruction might be viewed as a process of re-enactment so the reader might take on the ‘role’ of the researcher and actively pursue the same lines of enquiry as demonstrated by the Wren plan ‘game’.

Visual Paradigms

As we have seen, the researcher seeking to present visual material faces very particular problems which relate to the user's ability to recognise the possibility of ambiguity. In order to avoid the 'passive disengagement' on the part of the reader, the researcher needs to ensure that the user remains 'activated'. It is clear that the researcher must present the model outcomes of their work but it seems likely that this presentations adopting interrogative rather than discursive modes might be more effective in communicating their process. It is crucially important that the researcher does not simply rely on concepts of 'interactivity' to activate the user since (as Favro has found) devices such as immersive VR have proved extremely counterproductive. Models developed in this mode must focus on the ways in which the process of passive disengagement may be disrupted. The models may be holistic or focus on smaller details (or move between the two modes) but interrogative presentations of this kind might usefully feature some form of metaphorical presentation of material.

Approaches which focus on smaller details (and moments of exploration in 'narrative' models of process, above) abstract elements of the overall model from its broader context and might therefore benefit from diagrammatic approaches which draw on object metaphors. The 'point of view' conceptual model of space-time (above) requires the user to mentally reorient the tube in order to perceive a different interpretation of events. Where the researcher seeks to explore the consequence of a single choice they might present the user with metadata and paradata and allow them to explore different visual outcomes

Demonstration 4 – Lenticular Paradigm

The observation of causality is our principal method of learning. From the throwing of toys to the Large Hadron Collider, the ability to link cause and effect through observation or experiment is how we understand the world. Our ability to apply knowledge gained in this way to other situations through metaphor becomes a tool for understanding that which we cannot directly experience. Offering the possibility for the reader to establish a causal relationship with the presentation of information is to begin to offer access to insight which mirrors the experience of the visual researcher.

The *Hamlet* reconstruction offers an example of this principle in action. On the website, visit the 'outputs' section of the 1926 Hamlet reconstruction. Open the 'interactive demonstration'.

Here a visualisation of Hofman's process is presented as though a lenticular image. 'Dragging' your mouse 're-orients' the image to present changes through time.

by ‘reorienting’ the model – not unlike the effect of a lenticular image. The object could be presented from a dominant view which represents the researcher’s preferred outcome but the user could choose to explore different interpretations of the data by literally (or at least virtually) changing their point of view. An additional benefit of this approach (here termed the ‘lenticular’ paradigm) is the availability of two axis of movement which might allow the researcher to present more complex sets of judgements.

None of which, of course, addresses the need to present complete visualised outcomes. Researchers who choose to make more holistic presentations of model outcomes are subject to the most compelling and persistent aspects of passive disengagement. Favro’s experience clearly demonstrates that even the most intellectually engaged subjects have difficulty in making critical evaluations of fully visualised model outcomes. She does however usefully identify that there are two forces which shape the user’s experience – the visual and the kinetic. Researchers wishing to address problems associated with the visual experience of the user might valuably develop models which make use of the proxy metaphor. Hann’s work on Utopian Theatres (Hann, 2010b) makes significant use of placeholder objects in a way which mirrors the example of the black box in quantum physics. These objects clearly fulfil a structural function without making significant statements about form, colour or texture. Although this approach has proved effective it does produce an absolute, binary approach to the problem which admits little room for suggestion on the part of the researcher. A more flexible model might adopt the example of renormalisation in which objects might be presented in different degrees of resolution depending on the security of their knowledge claims. Indeed it would be possible to make this effect (termed here the ‘renormalisation’ paradigm) interrogative so that users could effectively set a ‘tolerance’ level for conjecture, with objects falling out of resolution as they move beyond the user’s defined limits. The form that the ‘unresolved’ image takes should be carefully considered by the researcher. The reduction of resolution (image quality) is only one option. Cultural

references in film and in games indicate that defocussing, desaturating or placing objects into a state of 'flux' also suggest concepts of uncertainty[3].

I have made a distinction between the model maker and the visual researcher. The model maker acts principally as an illustrator, and while this does not deny their skill and valuable input into any reconstructive project, the model maker that is directed in their choices uses modelling practice as a tool. For the visual researcher modelling practice is a methodology which encourages insights which would not otherwise have been available. Virtuality does indeed offer "new ways of knowing" (Dennard, 2002:36).

The development of historical methodologies that are built on processes of digital reconstruction allow us to engage in modes of analysis which acknowledge the unique nature of visual material. They reduce the need to describe pictures and artefacts (reducing their meaning to that which can be contained in words) instead allowing us to admit them into complex propositions in which they become materials rather than objects, with which we correspond rather than interrogate. Visual research allows the history of artefacts to 'speak' in ways that more traditional research does not. This 'correspondence' though does rely on the assumption that the material used has something to say.

We have seen how the 'appropriate pedantry' of the modelling environment initiates this 'correspondence' by drawing questions from the artefacts we admit to the process, and it is striking that of all of the reconstructions undertaken as part of this study (there are nine in total) two have rendered significantly fewer insights than the others. The contributions of Palladio's *Teatro Olimpico* and Holland's Drury Lane to the discussions in Part 2 have really only been illustrative. Knowing what the Olimpico looks like helps us to understand Scamozzi's work better, but the process of reconstructing this theatre did not offer any additional insights. This is also true of the Holland reconstruction in all respects other than the stage area. These reconstructions were both approached as 'technical' reconstructions and based on complete data sets –

[3] Though we should note that in the case of Denard's Abbey Theatre Project (2011) the act of simply desaturating the image actually increased passive disengagement when used in still images as it was evocative of historical photographic evidence.

in the case of the Olimpico, we have access to complete plans including detail for the *scaenae* and statues and a full site survey. The absence of any doubt in these data sets has meant that the process of model making has lost its propositional nature. The materials ask no questions and there are no theories to establish and test. In these cases the model making process is just that, a process of illustration and not a methodology applied by a visual researcher. While their contribution to the individual case studies may have been minimal, the example of these two reconstructions is an essential demonstration of where the value of visual research lies and under what circumstances it represents an appropriate methodology.

> The study of the history of theatrical spaces, has no more to do with the understanding of the drama than the study of the history of printing has to do with the understanding of poetry. Joel Springarn (in Carlson, 1989:1).

Whatever position one may take on Springarn's burgeoning Post Structuralist sentiment, he is most certainly wrong in one very important regard. In the last 40 years, developments in the history of printing have been so radical as to be impossible to ignore. The removal of typists and type setters from the process, and the transfer of the responsibility for the preparation of print ready copy to the author, alongside the development of word processing software has made the process of writing radically different. More importantly, these processes are so deeply embedded in the everyday working practices of most of the population that these developments fundamentally change the way that we **all** think about writing. So even from a strictly post structuralist view point, an understanding of recent developments in the history of printing are critically important to our contemporary understanding of poetry. The introduction of domestic computing, (initially only as a tool of facilitation) has led to the development of a range of new methodologies which have fundamentally changed the nature of the experience of writing and by extension, of reading.

In this case, the metaphor is quite clear, The understanding that I gain through visual research is so fundamentally dependent on my process as a visual researcher that I cannot possibly expect a reader to share in that understanding if they do not also have some form of experiential engagement with my methodology. If I do not provide opportunities for this engagement it would be

as though I had written a paper which presented only source material and conclusions and provided no discourse. The knowledge claims of my conclusions may be strong but we must conceive of knowledge and understanding as distinct and in the context of visual research, **understanding** moves beyond simple knowledge and is rendered only through procedural engagement with the material in question.

Founded in a series of case studies driven by reconstructive practice, this study has sought to articulate the complexity of issues faced by the visual researcher. In exploring the impact of various forces on both procedural and objective engagement with computer reconstruction, I have attempted to re-set problems at the heart of the discipline with a view to establishing a more productive engagement with the issues that shape our thinking about the ways in which the findings of visual research may be communicated. The identification of distinct modes that may be occupied by a single model (procedural and objective) and the separation of practice from process, knowledge from understanding has facilitated a re-evaluation of acts of reconstruction from a number of perspectives in order to seek a more profound understanding of the application of the technologies involved.

From a theatre historical point of view the logical development of this project would be closely linked to the initial proposals suggested by the deployment of metaphors in the presentation of material in the Hofman Case Study (the ‘lenticular’ paradigm) and the Drury Lane case study (in the exploration of discursive and interrogative time in the development of the Wren ground plan). These examples demonstrate the potential for authored exploration of digital models but do not propose a comprehensive approach nor present a complete dissemination package.

The potential for future application of this work though is not confined to the discipline of theatre history. The exploration of reconstructive practice presented here and in the accompanying web archive demonstrates the methodological potential of digital reconstruction both as research process and as a form of knowledge production. The impact of this extends significantly beyond the field of theatre history to include a range of visual and historical contexts, and offers a strong strategy for the rehabilitation of digital reconstruction from its familiar

illustrative role (particularly in archaeological and cultural heritage contexts) to a more engaged productive method of research and communication.

These case studies though, move beyond a simple reproductive mode and offer the possibility for digital reconstruction to explore less tangible histories. The Hofman study for example provides a compelling argument for the potential of reconstructive practice to explore abstract conceptual as well as physical spatial development, while both the Italian and Drury Lane projects address issues of ideology and identity.

Furthermore the conceptual frameworks developed here provide useful tools for researchers engaged in wider discussion of Practice as Research. The exploration of the relationship between the practice, the artefact and the reader addresses the potential for alternative approaches to the design of dissemination projects and places an emphasis on problem setting and authorship which would be equally applicable in contexts ranging from performance practice to manufacture.

Part 2:
Architecture and Aesthetics

Perspective and Framing – The Italian Renaisance

Palladio's *Teatro Olimpico* at Vicenza (1585), and Scamozzi's *Teatro all'antica* at Sabbioneta (1590) present a clear blending of vernacular and high style. Each owes a great deal to contemporary staging practice as articulated by Sebastiano Serlio in his *Treatise of Scenes* (1545) but each also presents a very clear 'idiosyncratic' message. In *Theories of the Theatre* (1984) Marvin Carlson argues that Italian theatrical theory in the second half of the 16th century is characterised by the rediscovery, adaptation and colonisation of Aristotle's *Poetics*. Through Rabortello (1549), Lombardi and Maggi (1550), Vettori (1560) and finally Scaliger's *Poetice* (1561), he traces a growing sense of scholarly independence, moving from simple commentary to the development of an essentially Italian (though still largely Aristotelian) *Poetics* in Scaliger. For Carlson though it is Castelvetro's 1570 commentary that attempts to develop a genuinely independent poetic system – one that directly contradicts Aristotle and focuses not on the analysis of drama itself, but on the drama in the light of the needs of the audience. Castelvetro eschews the need for instruction in drama and states clearly that drama is for **all**, and perhaps most significantly, that drama is for the spectator and hearer, not for the reader (Carlson, 1984:37 - 51).

If we are to accept this model of maturing artistic independence, then it is clear that while Palladio's *Teatro Olimpico* at Vicenza (1580) owes much to the appropriation of classical forms[1], Scamozzi's *Teatro all'antica* in Sabbioneta (1590) is more indicative of the assertion of a new, independent Italian form. In the context of this study, the significance of both Serlio's theatre scaffold and Palladio's *Teatro Olimpico* lie in their influence on Scamozzi's *Teatro all'antica* the exploration of which is the principal aim of this case study.

[1] Gian Giorgio Trissino, founder of the commissioning Academy at Vicenza was a noted translator of Aristotle and Palladio's patron and mentor. Palladio himself was the century's principal interpreter of the works of Vitruvius; indeed It was Palladio that provided the illustrations for Barbaro's 1556 commentary on Vitruvius' *De Architectura*, most notably in this context the illustration of Vitruvius' plan for a theatre which is still regarded as the definitive interpretation (Figure 21).

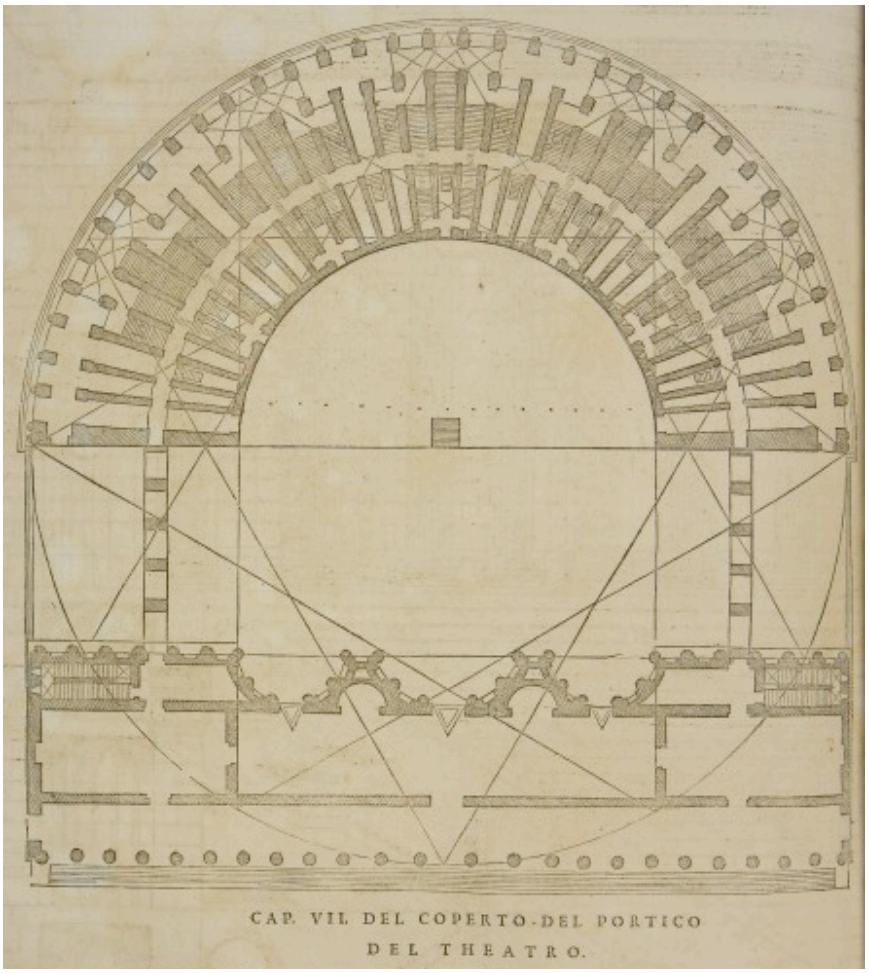


Figure 21. Palladio's interpretation of Vitruvius' plan for a theatre (Barbaro, 1556:171)

Plans of the *Teatro Olimpico* are sufficiently clear to make a technical reconstruction unproblematic. Indeed the building remains in use and almost completely unaltered today and available for survey. Extant material which supports the work on both Serlio's theatre scaffold and on the *Teatro all'antica* is more ambiguous. The text that accompanies Serlio's plans[2] acknowledges that the description is incomplete and this has allowed some commentators to make significant assumptions about his use of curtains and framing or masking devices (see Kernodle in Hewitt et al., 1958). What **is** clear from Serlio's work is that he has treated plans for the scaffold differently to the drawings of the stage designs, and that this reveals certain assumptions that he makes about perspectival scenery. The existence of both plans, and images which may be

[2] This reconstruction has drawn on 2 translations, the 1611 English translation available in a Dover reprint (Serlio, 1982) and Allardyce Nicoll's translation (in Hewitt et al., 1958)

intended as indicative rather than technical means that reconstruction on this project is undertaken partly in 'technical' mode and partly in 'visual' mode.

Scamozzi's plan and section for the theatre at Sabbioneta do superficially contain sufficient information for a technical reconstruction but close examination shows inconsistencies which are in themselves revealing. This theatre too remains in use, but has undergone a number of reconstructive refurbishments which make definitive survey of the space difficult.

The propositional nature of the Serlio and Sabbioneta models has meant that the deployment of a form of 'white card' modelling has been useful. These models do not propose completed realisations of the spaces (though the Serlio has been located in a courtyard setting) but offer experimental models which might be more correctly regarded as manifestations of the plans rather than of the final structures.

Serlio's Theatre Scaffold

The most significant question raised by **this** reconstruction has been that of Serlio's intention for his sketches of the scenes. In the *Treatise of Scenes or Places to Play In* (1540, Dover reprint of 1611 English edidtion 1982), he has included three 'designs', Comic, Tragic and Satyric, each presenting a scene receding in perspective, these scenes were intended to be compressed into a stage no more than thirteen Venetian feet (a little over 14'7")[3] in depth. The **intention** of these sketches has never really been examined but the attitude of those who have explored them seems to be that they represent actual designs for stage settings. This has been supported by the fact that construction of the Comic Scene (Figure 22), bears close relation to the setting on the stage of his "ground [plan]".

Conventions of perspectival scenery dictate that the 'prime' position (that for which the perspective of the scene is fully resolved) would be that of the patron. In Serlio's scheme this would be in the centre of the front row, on classical

[3] Serlio reproduces a number of measures throughout the *Architettura*, his Venetian half foot measures 6 ¾ modern inches.

models. This assumption is supported by his use of this point of view in images demonstrating the structuring of the scaffold and positioning of the scene. The sketches however, offer a more 'idealised' view, slightly further back and some ten or so feet higher (a position at which there was no seating). This is a position from which it is easier to make sense of the perspectivally altered floor, but his groundplan of this clearly indicates a foreshortening dictated by a point of view which is much lower (a point difficult to prove mathematically but obvious in reconstruction). The point of view for which the floor is designed is one only slightly above the level of the stage, from where the effect of real perspective on the flat forestage merges with the raked and perspectivally painted picture stage (Figure 23). From the point of view used in Serlio's pictures of the scenes, there would appear a sharp demarcation between the two stage sections which would expose the perspective (as in Figure 24).

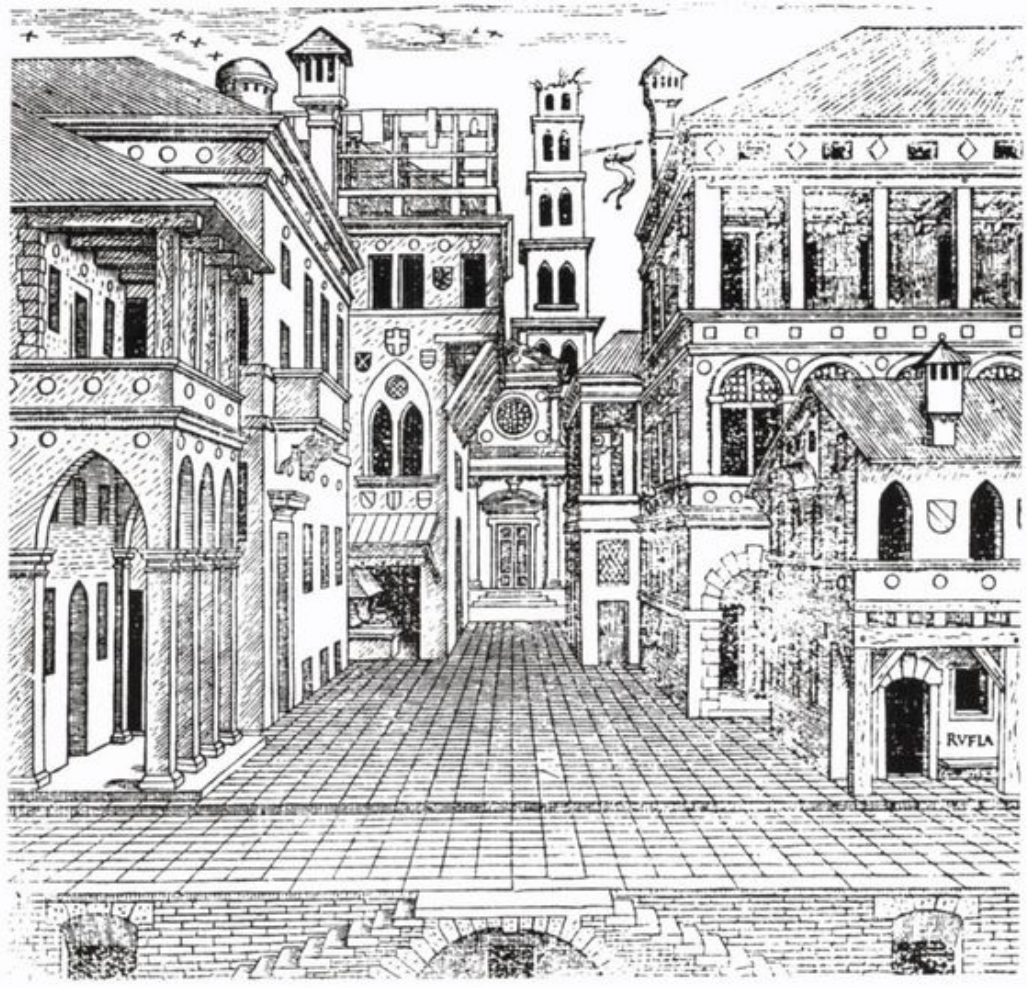


Figure 22. Serlio's sketch for *Comic Scene* (Serlio, 1982:25)

Figure 23. Serlio's *Comic Scene* showing the resolution of perspective of the floor. Reconstruction - Fergusson 2018

This is not the case. The sketches do not acknowledge the actuality of the perspectival painting, nor for that matter do they acknowledge any form of staging or framing. No attention is paid to the position of the scene in a physical location nor to the ways in which the scene may be resolved at the edges by way of overlapping flats or framing device. Serlio claims that attention to such detail would be “prolix” and leaves the details of the realisation of his scheme to “the imagination of those who are interested in such things” (Nicoll's translation in Hewitt et al., 1958:29).

There are a number of implications here, firstly and perhaps most obviously, that the sketches are not intended as scene designs but as suggestions of the ‘proper’ compositions of such scenes and an indication of how seamlessly the false perspective of the scene and the actual perspective of the forestage should work together. Prolixity aside, in the Tragic and Satyric scenes, the boundary between these two playing areas is not indicated at all.

The question of the raised point of view has, I believe led to some misinterpretations of this space. In Leacroft’s reconstruction (1982, above) he

does note that these are sketches rather than scale drawings, but it is really only the scale that he questions in his attempt to translate the pictures into model form. He also notes some of the more obvious difficulties in doing this, particularly in compressing the scene into so small a space. He does question Serlio's positioning of the prime seat, even though Scamozzi does not make any explicit statements about this:

> What is surprising, however, is that Serlio does not place his most noble personage at the optimum position for the perspective scene, i.e. centrally placed with his eyes on a level with the horizon (Leacroft, 1982:122).

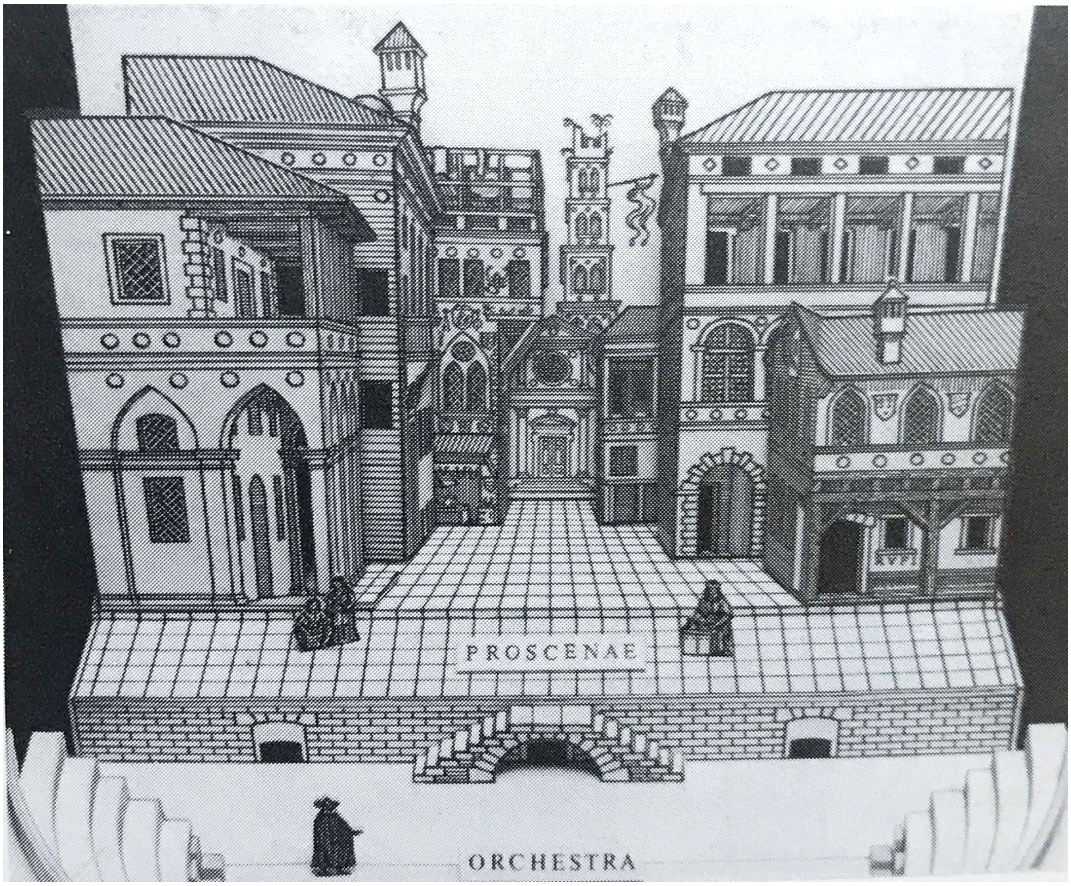


Figure 24. Leacroft's reconstructed *Comic Scene* (Leacroft & Leacroft, 1984:44)

His assumption may be driven by the point of view suggested by the sketches. Where Leacroft has photographed his models from this point, it is clear that this is in fact, not the ideal view (Figure 24). From here, there appears to be no coherence to the floor and the buildings, far from seeming real or imposing, are rather distant when compared to the view from the lower seats. Leacroft's floor may be partly to blame here, he follows the perspective suggested by the

sketches, which are, after all, two dimensional images, but treats the stage surface differently, replacing the sharply foreshortened texture suggested by the ground plan with a squared one (as with the forestage). Furthermore, he does not account for the perspective effect of the raked picture stage, which accentuates the perspective lines and demands a comparable alteration in foreshortening. In the scheme of Serlio's ground plan, the front row view is the only one where scenic stage and forestage appear as one. Again, this seems to be a point that that Leacroft misses, criticising Serlio for omitting a flat forestage in the Tragic and Satyric Scenes when it seems far more likely that having indicated the construction of the perspective in the Comic Scene, Serlio has simply not observed the demarcation line in his later sketches.

What I think is far more significant about Serlio's sketches is an implied attitude towards the perspective scene. The assumption has usually been that artistically speaking, the perspective scene was a celebration of the ingenuity by which a deep perspective vista could be credibly compressed into a relatively small space. But perhaps, Serlio's more picturesque than technically useful sketches indicate that it is the relationship to the stage to the pictorial image that is more important. The images may suggest that the real feat is in giving depth to an idealised flat perspective. Serlio presents a three dimensional stage that looks like an flat image of a street scene in perspectival style. His sketches may be more correctly interpreted as an 'ideal', an image to which the settings should aspire, and in this case the image is a perspectivally composed but a flat, picturesque one rather than realistic one. There is other evidence for this view. His comments on these settings have been translated as suggesting that they are being ""in relief" (Hewitt et al., 1958:25) have lead some commentators (Hart & Day, 1995) to assume that the flats should contain as much detail as possible, but elsewhere in the work he implies the reverse, that only where absolutely necessary should actual three dimensional pieces be used. Indeed although the forward buildings should be constructed of two 'booked' flats (one facing the audience and one 'return' painted in diminishing perspective) the rearmost flats can be a single painted flat, indicating both the front and side views of the building. So his use of "in relief" here would seem to indicate the raising of a flat object, rather than the compression of a full, street vista. This is a sense that is

more clearly communicated by the 1611 translation which instead uses the phrase “imbossed or raysed [sic] outwards” (Serlio, 1982:24)

If the original concept of the perspective scene **was** a picturesque one, then this would inevitably effect the works that followed and it might be that Serlio’s sketches have more to say about the development of sixteenth and seventeenth scenography than is immediately apparent.

In this ‘white card’ reconstruction (Figure 25), I have also included a context for the scaffold and scene, in this case The *Pallazzo Tiene* in Vicenza. Serlio himself says that his scaffold was built in a courtyard in Vicenza, he does not specify which one. The theatre has occasionally been credited to the *Porto Colleone* (Rigon, 1995) but while it certainly does have a suitable courtyard, the evidence used for the attribution is not clear. The *Pallazzio Tiene* is typical of Vicenza’s architecture of this period, and one of the few remaining examples of its type. This context has again, provided useful information. Firstly, the unease with which the painted architecture sit within the reality of the courtyard might indeed suggest some form of masking or framing device (Jones later found such a device vital to his scenes), particularly when one considers the praise with which the ‘realism’ of such scenes were greeted. Secondly, much has been written on the fact that these scenes only really work from the ‘prime seat’, that viewing the stage from anywhere else gives a highly distorted view. However, this would appear to only be true of the front seats, where the *cavea* remains semi-circular and some seats only really have a side view. Further back (even from the courtyard balcony), variations in the scenic vista are really only limited. One might not be able to see into the full depth of the vista, and the coherence of forestage and picture stage is lost but in essence one can still ‘read’ the perspective. Maurice Pirenne, reaches similar conclusions in is detailed analysis of Pozzo’s Assumption of Saint Ignatius (Pirenne, 1970). Pirenne finds that in Pozzo’s work, the illusion of depth is not reliant on the perspective of the observer and that while there may be certain ‘deformations’ of the illusion, a disruption of the sense of depth can only be achieved if one is very close and viewing from an extreme angle.

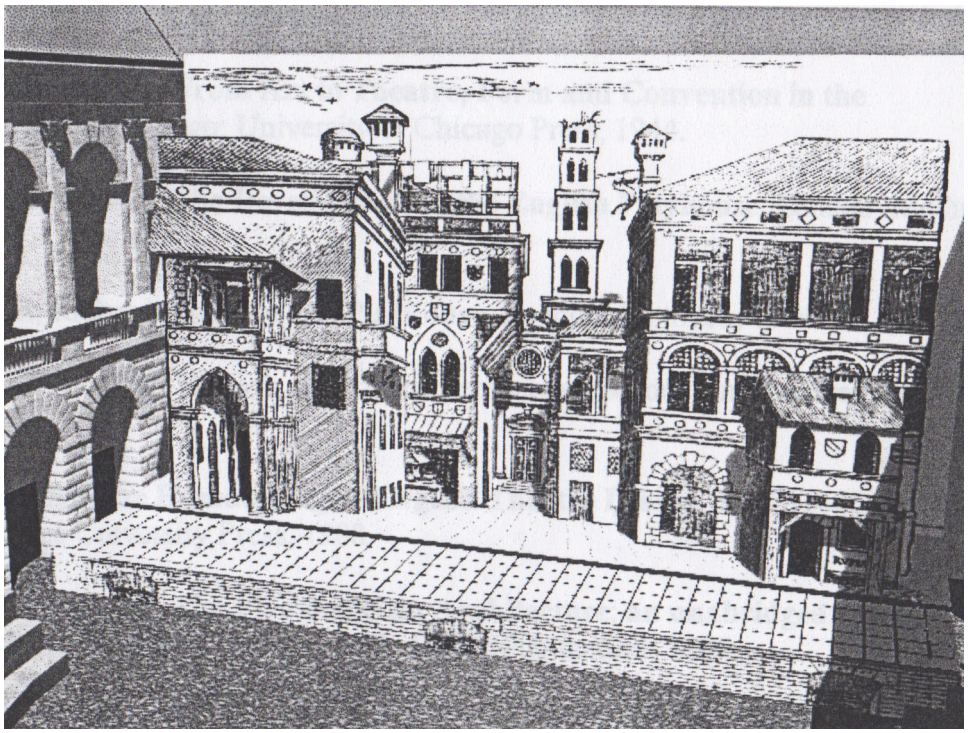


Figure 25. Serlio's Comic Scene, reconstructed in a courtyard setting, Fergusson.

This suggests then that the use of perspective staging might be more emblematic than illustrative. Kernodle's assertion that the quality of the resolution of perspective for each individual audience member helps to assert their social status relies on the existence of significant differences in this quality. Since this is apparently not the case, it may be that it was the **fact** rather than the quality of this resolution that was important. The use of perspective techniques, clearly implies a point of prime resolution that can be inferred from the setting. But if the effect is not really disrupted by point of view then it might be more useful to think about the way in which the setting 'looks' at the (person at the) point of prime perspective rather than the ways in which the audience look at the setting.

Teatro Olimpico

If Serlio's work demonstrates dominant modes of popular staging, then Palladio's *Teatro Olimpico* demonstrates a clear rejection of these modes. Palladio is widely regarded as the father of neoclassical architecture and it is clear that at the Olimpico, his intention was the restoration of a form of classical (and particularly Roman) theatre architecture.

Palladio had been engaged in a close study of the work of the Roman architect Vitruvius and in 1556 had provided illustrations for Barboro's commentary on this work. His expertise in this area led the *Accademia Olimpica* at Vicenza (of which he was a founding member) to commission him to construct a setting for the performance of a celebration of Hercules (who was regarded by the Academy as their patron). The success of these celebrations was such that in 1561, the Academy commissioned him once again, this time to build a wooden theatre 'in the style of the Romans' inside Vicenza's Basilica (Rigon, 1995:24). This structure was founded on Palladio's research on classical forms. Significantly here Palladio rejected contemporary staging practice in favour of a 'permanent' *scaanae frons* (Rigon, 1995:28).

It was not until 1580 though that the Commune of Vicenza granted the Academy permission to build a permanent theatre. Palladio appears to have been waiting for such an opportunity as work on the building commenced almost immediately. It seems likely that Palladio's scheme was the product of his study of Vitruvius, his experience with the wooden structure he created for the Basilica (for which he also acted as theatrical director) and subsequent explorations through model making (Rigon, 1995). The relationship between his oval auditorium[4] and his interpretation of the theatre described by Vitruvius is not immediately clear but Ottavio Scamozzi's 1776 history of Palladio's work (Scamozzi, 2015) contains a proposed analysis of the geometry of the *Teatro Olimpico* in which he demonstrates both the Vitruvian principals and Palladio's adaptations evident in the finished plan Figure 26).

Palladio died shortly after work on building the theatre started, but the availability of plans and models facilitated its completion in line with his design. As complete as his plans for the building were, Palladio did not leave any indication of his intentions for scenic presentation. There is some suggestion that he had intended to deploy some form of *periaktoi* in the openings in the scaenae (Rigon, 1995) and he has included them within the stage openings of his illustration of Vitruvius. Ultimately though, the Academy accepted an alternative solution.

[4] Dumont incorrectly describes the auditorium as a flattened circle in his *Parallele* (Dumont, 1774) but this is possibly a product of poor draftsmanship on his part.

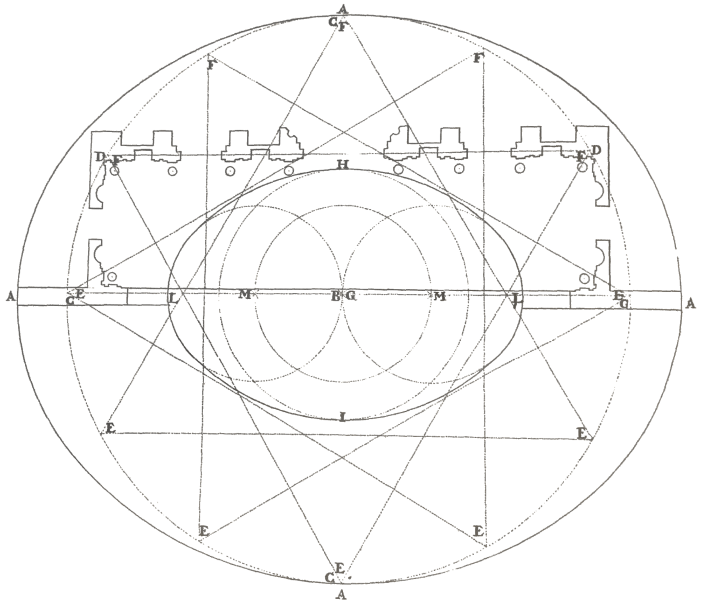


Figure 26. Geometrical Analysis of the *Teatro Olimpico*, 1786 – O.M. Scamozzi (Scamozzi, 2015:34)

Figure 27. *Teatro Olimpico* 1585. Reconstruction by Fergusson 2015.

The inclusion of perspective street scenes in each of the openings was overseen by another local architect, Vincenzo Scamozzi. It is certainly the case that these did not form part of Palladio's plan as the additional land needed to accommodate them was purchased by the Academy after his death. These

settings represent the streets of Thebes (designed for the theatre's opening performance of *Oedipus Rex*) and were so well received that they were adopted as a permanent part of the structure and remain in place today.

The reconstruction then (Figure 27) shows the building as designed by Palladio and without any temporary staging devices.

Teatro all'antica

Vincenzo Scamozzi's theatre at Sabbioneta was designed as part of a *citta ideale*, and as such seems to draw more heavily on the new Italian aesthetic as exemplified by Castelvetro. Furthermore, the apparent negotiation of form between the time of the production of the (undated) plan and section by Scamozzi and the actual building of the theatre (1588-90) presents an opportunity to explore the tension between the 'idiosyncratic' symbolic meanings intended by the architect on one hand and patron on the other. The 'white card' model (Figure 28) seeks to explore the building as proposed by Scamozzi in the undated plan (Figure 29).

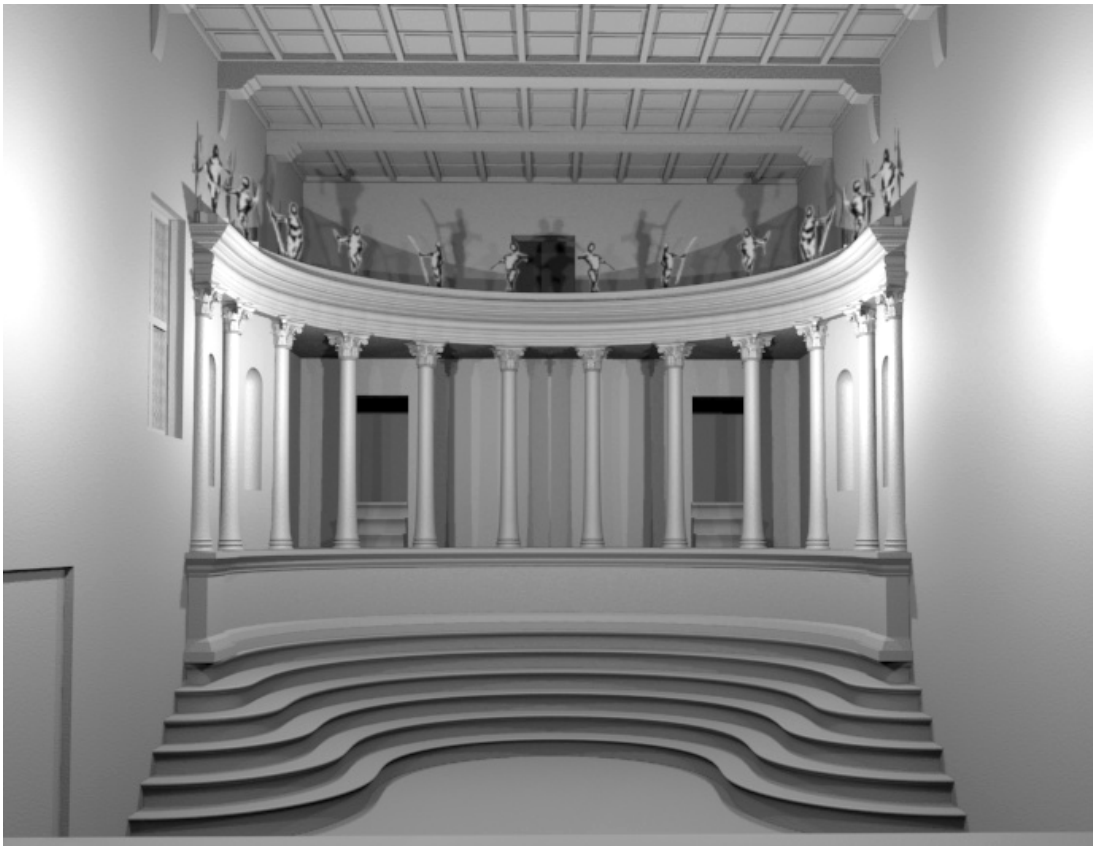


Figure 28. 'white card' model of Scamozzi's vision of the theatre at Sabnioneta, Fergusson 2015.

Scamozzi's design (Figure 29) contains significant detail and clearly represents his work at an advanced stage of planning. It is however also clearly a sketch rendering of the structure, with variable qualities of accuracy and draftsmanship. The plan appears to have been used at some stage as a 'discussion document' annotated and altered, apparently with a different pen (suggesting that the plan may have been revisited more than once) and in some places possibly by another hand. It is also clear that the plans underwent further revisions prior to the completion of the theatre itself, in which there are some structural differences that are unlikely to have been made as part of a later remodelling exercise.

Superficially, the drawing seems to contain all of the information necessary for a detailed historical analysis. Close examination of the detail however, indicates that there is a great deal of contradictory information which must be resolved in order to engage with processes of digital reconstruction.

The plan is marked up in two scales; the local measurement of Sabbionetan arms (*Braccio* hereafter BR) and Scamozzi's native system of Venetian feet (*Piedi*, hereafter P). The bottom of the plan indicates that the overall length of the plot is 79 1/6 BR and gives its equivalent as 112 P This makes one BR equivalent to 1.4147 P (about 45cm or 1 cubit)[5]. Since these measurements are part of a clear and considered statement of the size of the plot, they are likely to be accurate[6].

The width of the plot is also marked as 38P. The fact that the plot measures to round numbers in feet rather than arms might suggest that deeds of ownership in this region were originally described in the Venetian system, and that the

[5] The number 1.414 will be familiar to anyone who has encountered the principals of sacred geometry as it is the mathematical value of √2, also known as the Golden Section or Divine proportion. We should be cautious about making assumptions here though as in Vitruvius also articulates it as the relationship between the foot and the arm in his 'man'.

[6] Neither system indicates a named subdivision but the use of fractions on the plan suggests that each unit was divisible by 12 (as was customary with other measuring systems) but the use of the denominators 2, 3, 4 and 6 mean that the measurements of 1, 5, 7 and 11 subdivisions are absent from this system.

Braccio was subsequently imposed as a new system of measurement as part of Gonzaga's plan for the *citta ideale.*

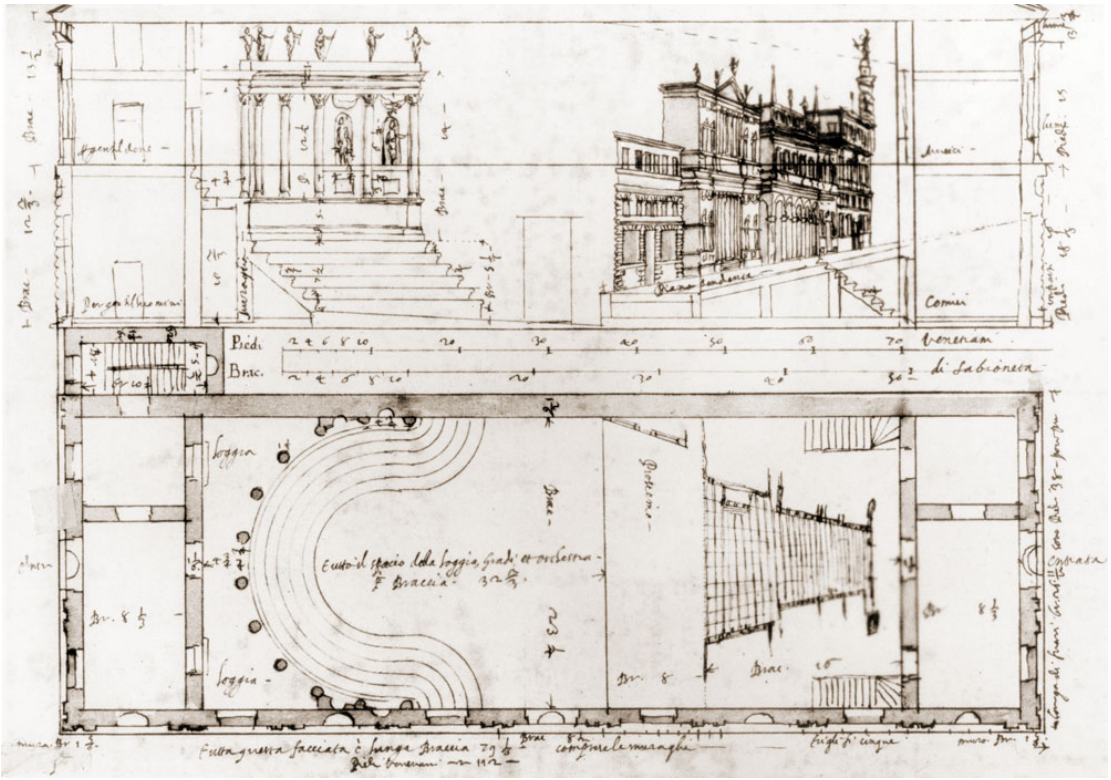


Figure 29. Plan and Section for the theatre at Sabbioneta (Scamozzi, 1588)

The size of the plot may be of some importance. While the conversion of Royal Tennis courts into temporary theatres was not a common practice until the seventeenth century, the dimensions of the plot of the *Teatro alla'antica* suggests that the shell of the building matches the dimensions of those structures almost exactly. This theatre was purpose built and not part of a conversion project, so the **choice** of these dimensions is significant. In his history of Royal Tennis in Renaissance Italy, Thomas Tuohy claims that the first record of such a conversion is in 1547 when Cardinal Ippolito II d'Este had the *giuoco della palla* (Royal tennis court) of Ferrara's ducal palace converted for the performance of a tragedy by Giraldi Cintio (Tuohy, 1996:215)[7]. At the time of this performance Gonzaga was sixteen years old and at the Spanish Court so it is unlikely that he would have been present, but Este was Gonzaga's second cousin (once removed) by marriage, a fellow patron of the arts and a

[7] I am indebted to Cees de Bondt of the Real Tennis Society for his assistance in establishing the dates and provenance of this claim.

close friend of his second cousin, Cardinal Ercole Gonzaga so he would certainly have known about the event and would have had access to detailed accounts.

There are three points of direct comparison of the two scales of measurement in use on Scamozzi's drawing, the first refers to the length of the plot (which we have dealt with), the second to the height of the first floor of the outer structure. This is marked on the left hand side of the drawing at 12 2/3 BR and on the right hand side of the building at 18 1/? P (this fraction is difficult to read, it appears to be 1/8 but it is unlikely that this is a fraction which would have been used in a measurement system with 12 subdivisions). An accurate mathematical conversion based on the established ratio would make the height here less than 18 P and while some inaccuracies are to be expected, one which misrepresents the major measurement (18 rather than 17 *piedi*) is likely to be an error.

The final point of comparison is in the width of the plot, which is gives on the right hand side of the plan as 38 P but nowhere in BR. However, in the body of the plan the width of the auditorium is marked (23 ¼ BR) as are the widths of the two outer walls (one of which is 1 2/6 and one of which is 1 3/6) this giving a total of 26 1/6 BR. An accurate mathematical conversion here would be 26 5/6 BR.

Conversion between the two systems of measurement in use at Sabbioneta is not an easy process, indeed without the benefit of decimal fractions mathematical conversion becomes impracticable if not impossible[8]. This may of course account for some of the discrepancies in written measurements on the plan but in truth these inaccuracies are surprisingly marginal, the conversion ratios vary from 1:1.4147 to 1:1.4522 which is difficult to account for in terms of mathematical errors. This would suggest that rather than carrying out a mathematical unit conversion, Scamozzi has simply used a conversion table or dual scale rule of some form to mark up his plan, a practice which is itself prone to errors.

[8] I am indebted to Professor Tim Scott for expanding my understanding of arithmetic with complex fractions.

The practice of using two different scales is inevitably confusing (and as we have seen, inaccurate) yet it has clearly been deemed necessary on this project. The simplest explanation for this would be that the plan was to be used to derive information for people (or groups of people) who were more comfortable with one or other measurement system but not both. Given his work elsewhere, it is likely that Scamozzi was absent for much (if not all) of the construction work and would have needed to 'brief' representative craftsmen on his intentions.

The overall dimensions of the building (stairs, doors, wall thickness etc.), the details of the seating blocks and elements of the underlying geometry of the space are marked up in Sabbionetan Arms, while the stage side of the building and the details of pediments, coving and statuary are marked up in Venetian Feet. It seems likely then that while Scamozzi was happy for the shell of the building to be constructed by local craftsmen, the details of the décor and the stage carpentry were to be undertaken by non-local (and probably Venetian) artisans[9].

Measurement systems aside, there are some difficulties with the drawing. Most obviously, the top level of the building (above the loggia) is curtailed by a good 2 BR as the draftsman apparently ran out of paper. This makes some elements of the structure difficult to interpret – particularly the broken line on stage which may indicate a suspended ceiling but is bisected by an element of the setting. No physical evidence for this ceiling remains beyond a clear indication of some form of perspectival termination of the frescos (Figure 30, visible behind the setting to the right of the image). It is possible that Scamozzi devised a perspective barrel ceiling for the space (Sabbioneta, 2013), if so, this might account for the apparent contradiction between setting and ceiling indicated in the drawings. Although the custodians of the theatre itself claim that this is the case, referring to a conical structure similar to the upturned hull of a boat, they do not necessarily claim that this structure was actually deployed there. The proximity of the beam supporting the roof and the indication of a straight and

[9] This assumption is supported by indications that this was indeed the case with the frescos, which are variously attributed to Bernardino Campi (Puerari, 1955) and Paolo Veronese (Sabbioneta, 2013)

level (but now absent) row of supports on the back wall of the stage (Figure 30) suggests a flat ceiling following a perspective line. It is also possible that the conjunction of ceiling and setting on the plans might also be accounted for by assuming that the plan is intended to indicate the ceiling's distance from the roof and should therefore be interpreted as being some 2 BR higher.

It is interesting though that Leacroft's 1984 reconstruction of this theatre (Figure 31) does not address the possibility of a ceiling at all, framing the vista instead with a series of scenic headers for which there is no evidence. It is possible that Leacroft's inclusion of these headers has been influenced by Kernodle's assertion that they formed part of Serlio's scheme (Hewitt et al., 1958) and that their use was commonplace in perspectival settings. The evidence on which Leacroft bases his reconstruction is not clear and the physical model does not necessarily require him to account for apparent contradiction (or indeed confront it) in the same way that the digital model does. This is of course indicative of one of the more problematic ways in which convincing reconstructive research can be seductive in its tacit assertion of authenticity.

Figure 30. Roof Area Above the Stage (with modern reconstruction of stage setting)

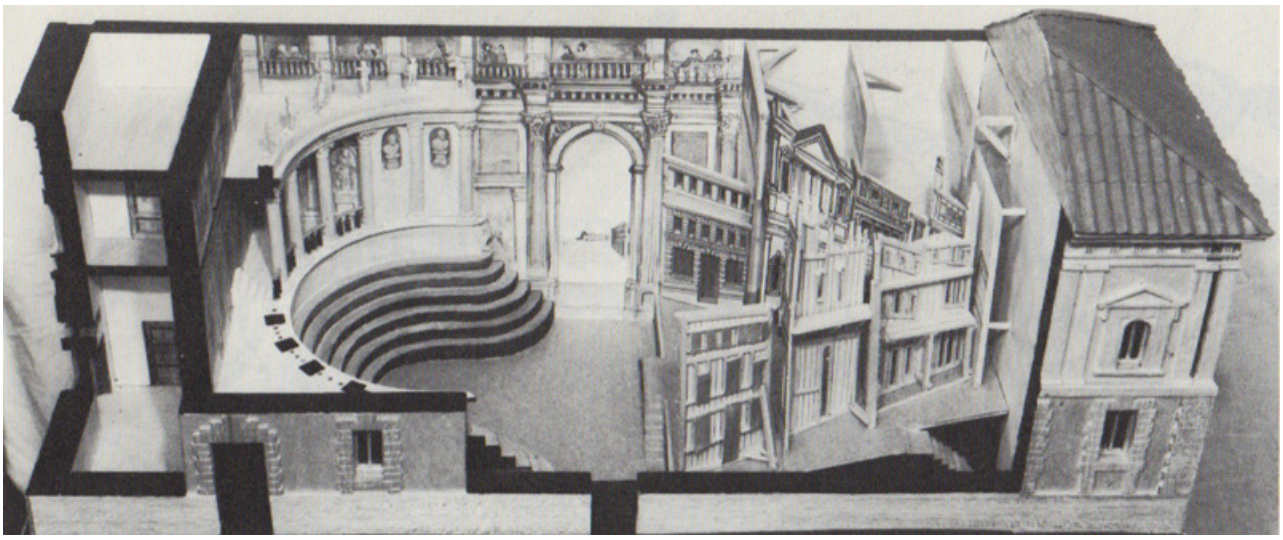


Figure 31. Richard Leacroft's 1984 Model Reconstruction (Leacroft & Leacroft, 1984)

There is also an apparent error (or subsequent adjustment) in the drawing of the seating blocks. Measurements stated on the plans indicate seating up to a level of 5 ¼ BR and this is supported by the marked height of individual seats. but the drawn size of the block is considerably larger (closer to 7BR).

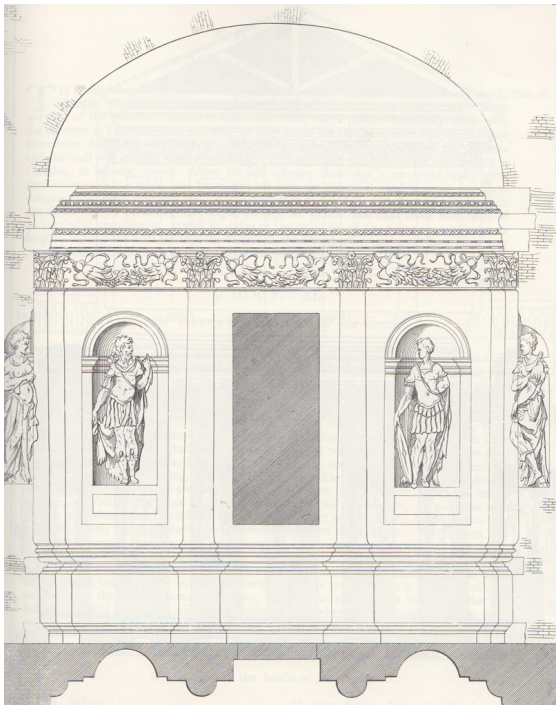


Figure 32. Illustration of Corinthian Halls (Palladio, 1965 Book 2, Chapter 9, Plate XXVII)

Taken with the foreshortening of the upper part of the building this makes the reconstruction (Figure 28) visually quite different to the impression given by the

Scamozzi drawing and has the effect of creating a significant sense of open space and placing greater emphasis on the loggia.

Other measurements relating to the loggia are correct but it is interesting to note that the form taken for the sketch of the pedestal, column, lower statuary and pediment are very similar to Palladio's second illustration of 'Corinthian Halls' (Figure 32), which incidentally also features a barrel ceiling.

One final problematic measurement is that of the stage opening, which Scamozzi has chosen to make 23 ¼ BR. This becomes particularly problematic when one considers the underlying geometry of the space. Both John Orrell (1988) and Iain Mackintosh (1993) have explored the notion of sacred geomery (in particular *ad quadratum* geometry) with relation to historic theatre spaces and have demonstrated the importance of underlying geometry to the architects of this time. In this context, a stage width of 23 ¼ BR would be unusual when the stage depth is so clearly marked as 24 BR, suggesting a more elegantly ordered stage width of 24 BR (which would have been possible within the limits of the building plot – see page 125), making a perfect square. This would allow for an audience area which matched and mirrored the stage in size with a shared (or marginal, potentially liminal) space between audience and stage with some underlying geometrical significance. In *ad quadratum* geometry the first order of significant extension of a square is a rectangle with a base equivalent to $\sqrt{2}$ of its height, this is termed the 'golden section', and is described by the arc of a circle with a radius equal to the diagonal of the square (Figure 33).

The difficulty presented by the drawing here is that this is not only a possibility but it is **exactly** as the ground plan has been drawn. The width of the stage does measure at 24BR and the underlying geometry of the form is clear but has been disrupted by the (apparently unnecessary) decision to reduce this dimension without making further adjustments elsewhere.

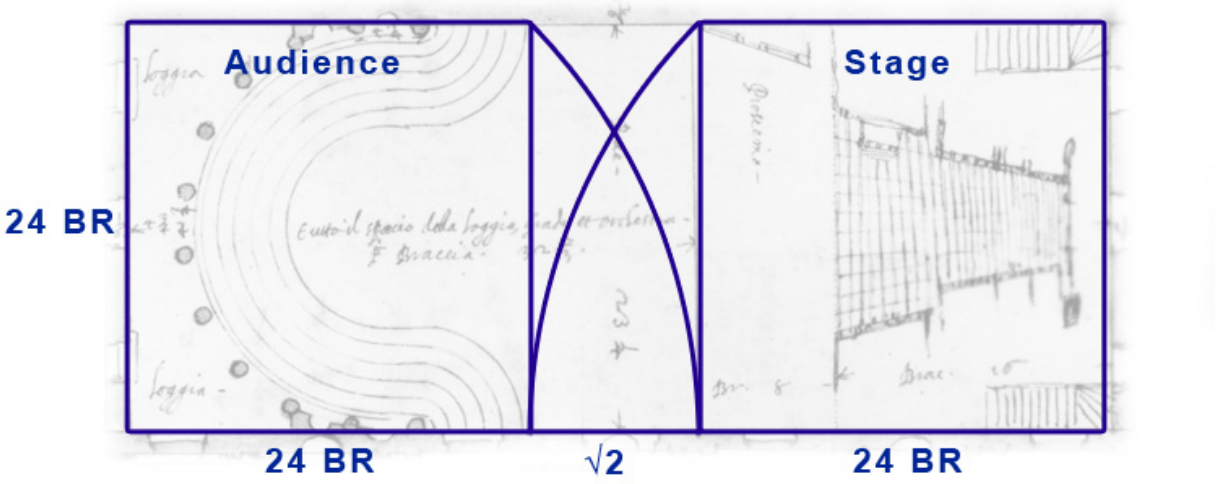


Figure 33. A Basic *ad quadratum* analysis of the plan.

The completed 'white card' model indicates that there are some significant structural differences between the theatre as drawn by Scamozzi and the theatre as it stands today, particularly in the auditorium. Scamozzi's plan does not include an auditorium entrance from the front of the building. We can assume that he intended that audience in the seating block should enter through the side doors and that the front doors should be reserved for access to the loggia. As we have seen, the use of perspectival scenery as a mode of staging, tacitly reinforces social hierarchies, the closer the proximity to the setting (as in the front rows in the Serlio reconstruction), the more pronounced the effect. The resolution of the perspective image only reaches perfection in the prime seat (here this is the Ducal seat in the loggia) but that the stage 'points' to a point of view of perfect resolution and the status of audience members is reflected in their closeness to a view of resolved perspective. Scamozzi's plan allows for a number of seats directly below the Ducal seat to occupy 'high status' positions. When the theatre was built however, these were replaced by the main entrance. The possibility that a small number of audience members might associate themselves with the 'ducal view' is replaced by the possibility (indeed probability) that all audience members engage with this view as they enter. This presents what is potentially a more democratic approach to perspectival scenery as it not only allows but requires every member of the seated audience to pass through a point of near resolved perspective before taking their seats.

The use of a propositional ‘white card’ form of modelling in this case study has provided opportunities for a ‘close reading’ of the visual artefacts. Questions raised by the process of model making have required a detailed interrogation and resolution of problems presented by the materials. This was particularly evident in the Scamozzi phase project where many of the key findings were a direct result of the need to resolve the two measurement systems with the annotations on the drawing.

It is clear from the reconstruction that the theatre at Sabbioneta draws on the work of both Serlio and Palladio but that in its assertion of a new form of theatre, it departs from both in significant ways. The stylistic debt to Palladio is clear, and in Scamozzi’s extensive use of statuary we can see that the values associated with classical antiquity remain important. Indeed while they are not represented on the plans, the theatre itself is decorated with frescos in a Roman vein, depicting audience above the loggia and vistas as though through the painted arches at the exits of the theatre – broadly reminiscent of the architecture at Ferrara. But Scamozzi’s plan does not adopt a Palladian form. Instead Scamozzi has adapted Serlio’s approach to perspectival scenery (which he had earlier explored at the Olimpico) as a focus of stage space, but far from being a temporary structure, this is a permanent theatre building which adopts the dimensions of Ippolito II d'Este temporary stage in Ferrara as an ideal scale.

It seems likely that the drawing was used to communicate or finalise some of the details of construction and that it formed part of a discussion between Scamozzi himself and representatives of local and Venetian craftsmen. Discrepancies in between dimensions articulated through the different units, suggest that conversion was achieved by use of a lookup table or simply measured from the plan with some form of scale rule. The way in which the drawing communicates the existence of this meeting is an example of the kind of ‘haptic insight’ which is frequently a product of this kind of visual reconstructive research.

The existence of two separate measurement systems on the drawing suggests a clear demarcation between the responsibilities of the two sets of craftsmen. The shell of the building was clearly constructed by local builders

but Venetian craftsman have been employed for the more specialist work on the statuary and stage areas. Sabbioneta was (and is) quite some way from Venice so this was clearly a significant choice given the additional time and cost that this must have involved. More so when one considers that not only was the Gonzaga family seat of Ferrara closer but so were the major cities of Mantua, Bologna and Milan.

Some of the most interesting findings of this study though, lie in the departures from the original plan. It is clear that the theatre was conceived with an underlying geometry, but the dimensions on the drawing do not all conform to this geometry. This apparently pragmatic and flexible approach to the formal aspects of building design is interesting in the context of Gonzaga's project and the maturing artistic independence evident in the work of Castelvetro. It would be difficult to imagine Palladio making such a compromise, indeed O.B. Scamozzi's analysis of the plan of the *Teatro Olimpico* demonstrates the lengths that Palladio went to in order to conform to Vitruvian geometry. Scamozzi's plan acknowledges tradition but prioritises practical and present concerns.

The finished auditorium features a central entrance, absent from Scamozzi's plan which apparently disrupts notions of perspective as statement of social status. The notion of the prime seat (so obvious in Serlio's scaffold and at the *Teatro Olimpico*) clearly formed part of the propositional plan but has ultimately been rejected in favour of a model in which the point of resolved perspective is occupied by an entrance to the auditorium, giving every spectator (and arguably the whole world beyond the theatre) a moment of perfect perspective.

Drury Lane, the English Model: The civic architect and Romantic sensibilities

Between 1790 and 1822 there were four different Theatres Royal Drury Lane. Having been remodelled by Robert Adam in 1775, the 1674 structure was demolished in 1790 in order to make way for a theatre with increased capacity (under the management of Richard Sheridan). Henry Holland's 1791 building was destroyed by fire in 1809 and the 1811 building designed to replace it by Benjamin Wyatt was gutted and remodelled by Samuel Beazely in 1822 in an attempt to address issues of acoustics and poor sight lines.

Holland's 1791 building[1] is radically different to the building it replaced, and one can trace in these differences, and in the recorded responses to these differences, a very public debate between actors and architects on the fundamental nature of theatrical space. There is a clear tension between the vernacular form supported by theatre professionals and the high style proposed and executed by a series of acclaimed and fashionable architects. This discordant moment can be better understood as an expression of the tension between neoclassicism and burgeoning Romanticism with its attendant fascination with the pictorial and the sublime. This case study will examine the original forms of both the 1674 and 1791 theatres in order to develop a clearer understanding of the nature of this debate.

Very little evidence of the 1674 structure remains, so a detailed exploration of available evidence and research process is necessary in order to establish the status of knowledge claims relating to this reconstruction. Detailed plans of the Holland building exist in collections at the Victoria and Albert Museum and the

[1] In this study, I will focus on the actors and architects, but in many ways it is equally useful to think of the 1791 building as Sheridan's theatre and the previous building as Garrick's. While the opportunities for idiosyncratic statement (as defined by Rapoport) offered by the enlargement of the auditorium were embraced by architects, the enlargement itself was undoubtedly financially motivated by the then manager. Conversely, the example of the previous iteration of the building was used throughout this period as an exemplar of theatre's ideal vernacular form, and notwithstanding his retirement in 1775, the memory of Garrick himself was still being evoked in defence of the old form as late as 1832.

Sir John Soane's Museum and this has facilitated a 'technical' mode of reconstruction where there is little room for a methodological engagement with the visual material. This second reconstruction though provides valuable illustrative context for an exploration of responses to the new space.

The Second Drury Lane Theatre

This reconstruction is based on the Wren drawing of a playhouse section (Figure 34). Since the textual evidence is of variable reliability and often contradictory[2], it is not possible to produce a reconstruction that can conform to all this evidence. This then is primarily a model of Wren's surviving design, not an exact reconstruction of the theatre as it stood in 1674 (for which there is insufficient evidence). It is likely though that the two differ only in matters of detail, The underlying form of this reconstruction provides sufficient illustration to examine the discourse between actors and architects.

Other evidence necessary for this reconstruction are an engraving of a performance of *Ariadne* (Figure 35) which was performed at Drury Lane in 1674 (reproduced in Thomas & Hare, 1989:102), and a pair of Robert Adam scale designs for the ceiling of the building (Adam, 1775) undertaken for his 1775 refurbishment (Figure 36). The precise match of elements of this known Drury Lane ceiling with the Wren section further indicates the likelihood of that drawing's connection with Drury Lane theatre.

The nature of the missing plan that would have accompanied the Wren section has been a matter of much scholarly debate (particularly during the mid 1960s). The principle matter for debate has historically related to whether the Wren section is representative of a fan shaped or 'U' shaped auditorium[3]. Southern

[2] Cibber for example clearly stated that in 1690 at least, the pit benches were curved, while the Wren section clearly shows straight benches. Mullin and Koenig (1966) use this discrepancy to dismiss Edward Langhans' conjectural reconstruction (1966) on the grounds that it departs from the Wren section in this regard - though elsewhere in the article they also dismiss it for **not** departing from the Wren section.

[3] The arguments for each form are consistent across all commentators. Supporters of the fan shape cite the diminishing perspective apparent in the section, and note that convention suggests that this theme was continued in plan. Supporters of the 'U' shape cite Benjamin Wyatt's claim that "the original theatres in Drury Lane …were all flat sided" (Wyatt, 1813:34),

(1952; 1962), Langhans (1966), Leacroft (1973) and Thomas (1996) all interpret the section as fan shaped and Mullin and Koenig (1966) and Garlick (1996) hold that the fan was added by a later remodelling project. While some (but not all) of these reconstructions have produced a model artefact, none have published a proposed ground plan.

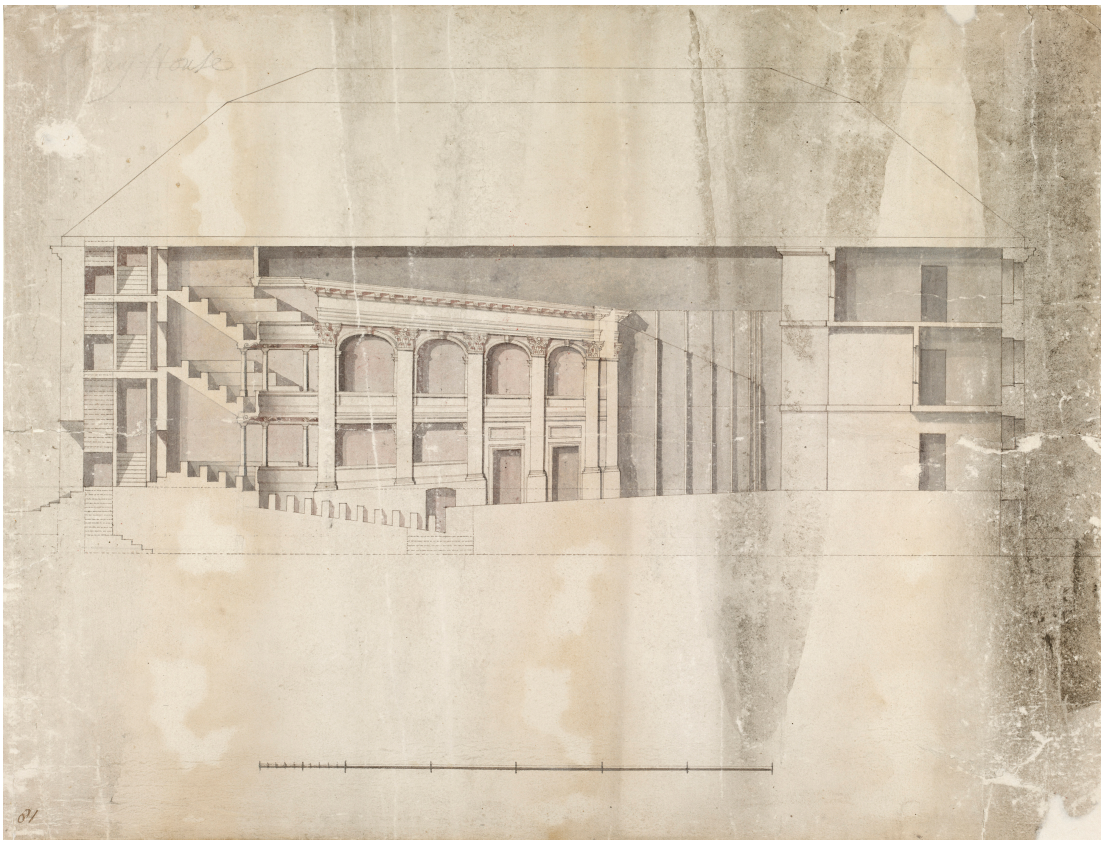


Figure 34. Section of an unidentified 'Play House'. All Souls College, Oxford (Wren, 1674)

In order to devise a plan for the theatre based on Wren's section and the Adam ceiling it has been necessary to make an assumption about the underlying geometry of the space. The section clearly indicates that there are a number of curved surfaces (balcony fronts, gallery benches etc) and for the purposes of the reconstruction I have assumed that these were based on a circular rather than an elliptical form (as is more usual in neoclassical architecture).

though the Adam ceiling designs demonstrate that Wyatt was at least in part mistaken in this respect.

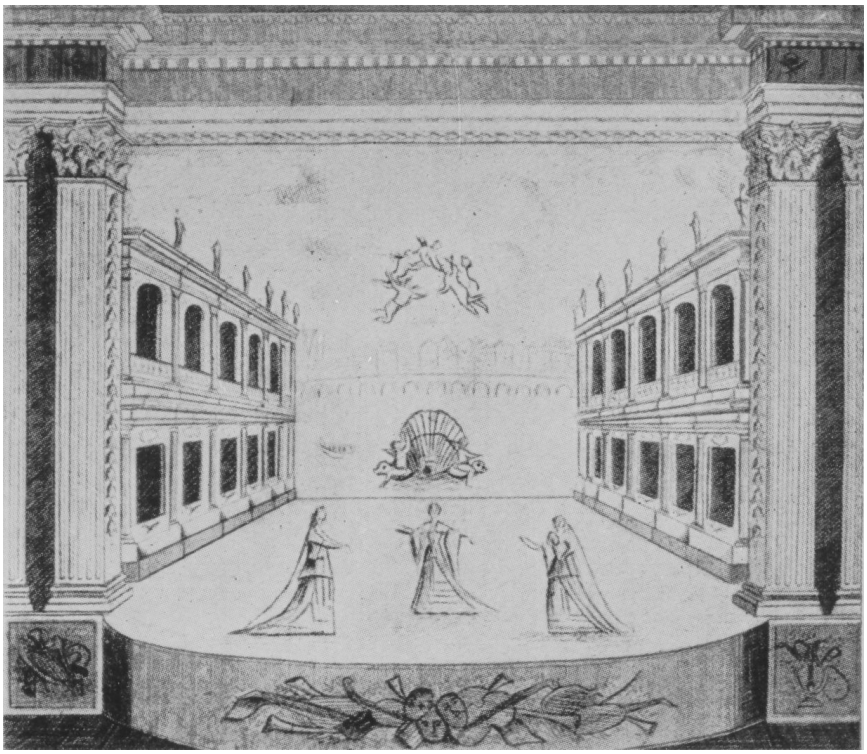


Figure 35. Setting for Grabut's opera *Ariadne*, Frontispiece to the Newcombe edition, 1674 (reproduced in Thomas & Hare, 1989:102)

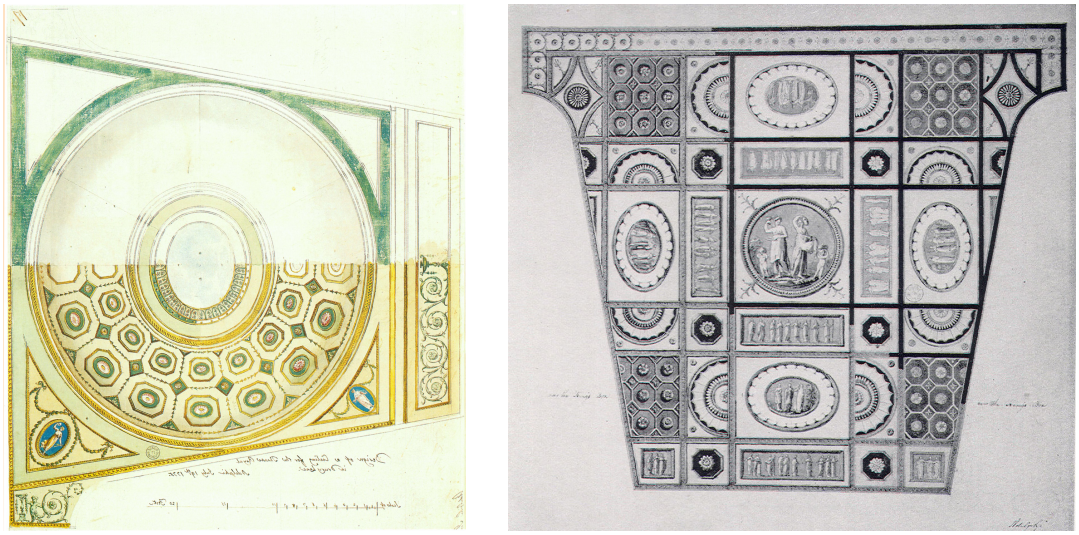


Figure 36. Two designs for the ceiling of Drury Lane Theatre. Robert Adam, 1775. Sir John Soane's Museum (Adam, 1775)

The Plan

The plan then is interpolated only from the Wren section, the Adam ceiling and the assumption that Wren was working to a circular form. In order to minimise the possibility of conformation bias, the known width of the plot and geometrical

analysis of the finished plan have been omitted from the process of developing the plan in order to be used to confirm its accuracy on completion. The plan has been established as follows.

The Adam ceiling design indicates that the auditorium was recessed at its widest point, this is manifested as ‘lugs’ on the designs. These are most clearly observed on the second (rejected) design. Matching the scale of the Adam drawing to the implied scale of the Wren drawing, it is clear that the length of the ceiling matches the length of Wren’s auditorium, and that the ‘lugs’ of the Adam ceiling fit exactly in the short flat ceiling space at the rear of the auditorium before the roof is raised to accommodate the upper balcony.

From the section, it is possible to measure the depth of the arc of the balcony fronts. Thanks to the correspondence noted above it is possible to also measure their width from the ceiling design - at the point at which the ‘lugs’ intersect with the diagonal boundary. Taken together this means that we can establish three points on the curve of the (assumed) circle that describes the balcony fronts. From these three points we can interpolate the centre of the circle and by extension, the plan of all of the concentric circles of the gallery benches and the forestage. It is true that Colley Cibber described the forestage as having a “semi-oval figure” (Cibber & Lowe, 1889:85) but we shall return to this apparent discrepancy later.

Having established the curved lines of the plan, it is possible to establish the line of the side walls from the ceiling design. Aside from the conventions of diminishing perspective, there are a number of reasons why the fan shaped auditorium seems more likely. Mullin and Koenig claim that the fan was added during the Adam renovations (1966:187) and this view is broadly supported by Garlick (1996:129-130) who concedes that it may have been added earlier. There are two significant reasons why this seems unlikely. Firstly, a contemporary account of the Adam remodelling emphatically asserts that there were no structural alterations:

> At first View I was a good deal surprised to find that by some means or other the ingenious Artists had contrived to give an Appearance of greater Magnitude to the House. I knew it was *not* rebuilt, but only repaired. *The Public Advertiser*, 30 September 1775 (reproduced in Sheppard, 1970:46).

Secondly, while there were a number of alteration projects between 1674 and 1775, they were all carried out with the aim of increasing the seating capacity of the house or in one instance during Garrick management, to remove audience from the stage. The introduction of a fan shaped auditorium would effectively replace pit benches with box seats and consequently **reduce** the overall capacity.

A close inspection of the Wren section also offers additional evidence. Wren's shading is reasonably consistent throughout and seems to be suggestive of 'ideal' light not situated within the architectural space. The shadows for the pit benches are consistent in their angle and length – if the 'light' existed within the structure, one would expect that the shadows of the front benches would be longer and higher than those of the back benches but this is not the case. The shadows from the dentils on the cornice of the side walls and the keystones of the arches gradually lengthen from back to front. Since we have established that this does not indicate their **location** in relation to the 'light' it must indicate a changing **attitude** in relation to the light and a convergence of the side walls.

Having established the lines of the curves and the fan shape from the Adam design, it is a simple matter of transcription to establish the transverse lines of the pit benches, pilasters, doors and arches, stage front, rake and setting. The termination of the gallery benches can be interpolated from the Adam ceiling but they are also clearly marked on the section.

And this is where the reconstruction reveals its most important insight. In respect of the termination of the benches of the first (pit level) gallery it is not possible to reconcile the section with **any** interpretation of the plan because there is a mistake on the Wren section[4]. Once spotted the error is obvious but in this case, it was revealed only as part of the reconstructive process[5]. The fourth (and back) gallery bench has been terminated at the point where the second bench should

[4] In truth, it is not the only mistake on the section. The evident ambiguity at the top of the proscenium is the result of a correction. New paper has been patched over an error, the new form has been 'roughed' in pencil and partly inked in before the drawing has been abandoned.

[5] It is possible that this apparent contradiction was the cause of departures from the plan in Langhans' reconstruction (departures identified as errors by Mullin and Koenig)

end. A simple comparison with the upper galleries indicates that this should not be the case. If (and here we must remember that this is an assumption) the theatre is built on a circular form, as it is drawn, this back bench extends significantly beyond the walls of the theatre.

It seems likely that this is an error caused by the fact that the much shallower rake of the first gallery means that the second and third benches are obscured by the balcony front. A close examination of the section supports this as construction points are visible and aligned as though all of the benches in all of the galleries have been marked up together. Working from the second (visible) bench backwards naturally places the first construction point where it is easy to mistake it for the termination of the rear bench.

If the theatre were constructed around an oval form (and Cibber claimed that it was) it would be possible to conceive of a plan where this is not an error, but the oval would need to be an extremely odd one and those (expensive) gallery seats would have a somewhat restricted view.

Here, we may be presented with another moment of ‘haptic insight’. The section is close to completion. It has been drawn, inked and shaded. An error has been spotted at the proscenium. The error has been patched, pencilled and partially inked, at which point, work on the drawing has apparently stopped. The correction has not been completed, the scale has not been marked up and the drawing lacks any text of attribution or authorship. It has however been torn through, twice. Again, a close inspection of the drawing provides additional insight. The tears cross at a single point. The downward tear has been executed with more force than the cross tear (which is less straight and shows more stratification). All of this can be accounted for if the first tear is carried out in anger (or frustration) and both pieces transferred to the dominant hand which naturally aligns the straight edges before a second tear is completed (with less anger or frustration – resignation perhaps). This is of course conjecture, but what is certain is that the drawing has then been retained (possibly as a reference for a new version) and exceptionally well preserved.

If we accept that this discrepancy is indeed an error then we need only establish the width of the proscenium opening. Unfortunately, there is no method to

definitively establish this from available evidence, but the *Aridane* engraving (Figure 35) offers guidance. As noted above, it is not possible to reconcile all of the evidence as there are some contradictions but the plan developed for this reconstruction has much to commend it (Figure 37).

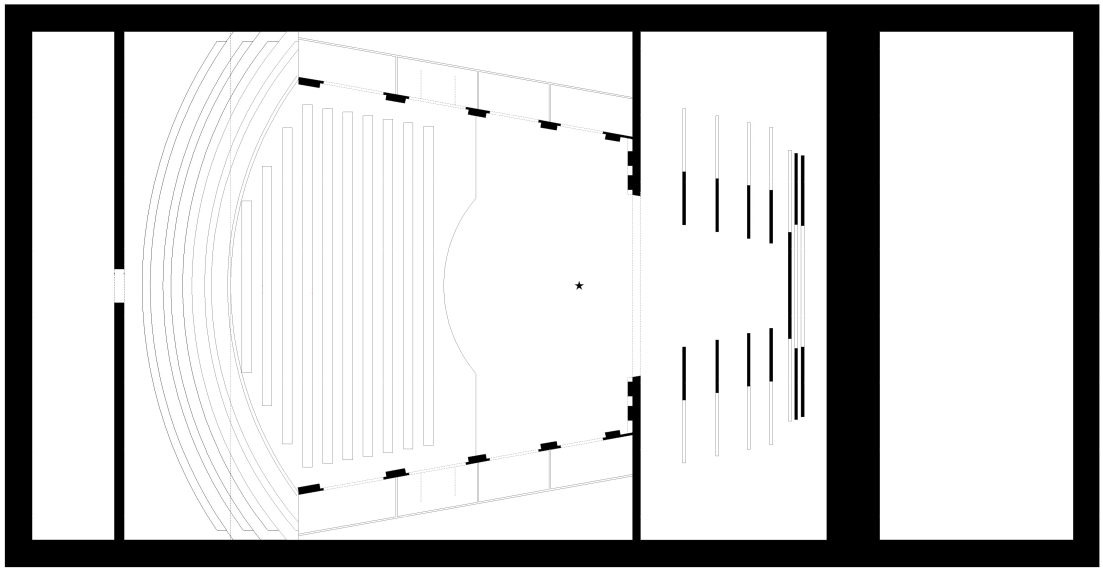


Figure 37. Conjectural plan for the Wren section. Fergusson 1999.

Before returning to those elements of analysis deliberately omitted from this process, it is worth revisiting two of the discrepancies identified by Mullin and Koenig in the Langhans reconstruction that are also evident here. Firstly, Cibber did indeed assert that the forestage was “semi-oval” and not a quarter circle as shown above, although Cibber described the stage some 50-60 years after the event and, geometrical pedantry aside, such a phrase could also loosely describe the quarter circle suggested by the section. So the form of the forestage here satisfies both the Wren section and (broadly speaking) Cibber’s description. Secondly, the *Ariadne* engraving clearly shows a forestage which describes a continuous curve, but it also fails to articulate any sense of the forestage that is clearly evident on the section. It is not unusual for theatrical engravings of this period to include this kind of inaccuracy, particularly when they were produced as frontispieces for volumes which dictated their format[6]. If

[6] The surviving illustrations for Elkanah Settle’s *The Empress of Morocco* famously present the stage at Dorset Gardens Theatre as significantly taller and thinner than is plausible (Settle & Dolle, 1673).

one reads this image as simply lacking a forestage, it shows that the front of the stage had a curved section rising within a straighter front line and that the width of the curve matched the width of the proscenium opening. Both of which are consonant with the proposed plan.

More importantly, a plan arrived at in this way does have an overall width of almost exactly 58 feet as is predicted by the slope of the roof on the Wren section and confirmed by the known dimensions of the plot. Furthermore, a *post hoc* analysis (Figure 38) based on Palladio's interpretation of Vitruvius' plan for a theatre (see page 112) shows that this plan significantly conforms to principles of Palladian architecture so evident in Wren's other work.

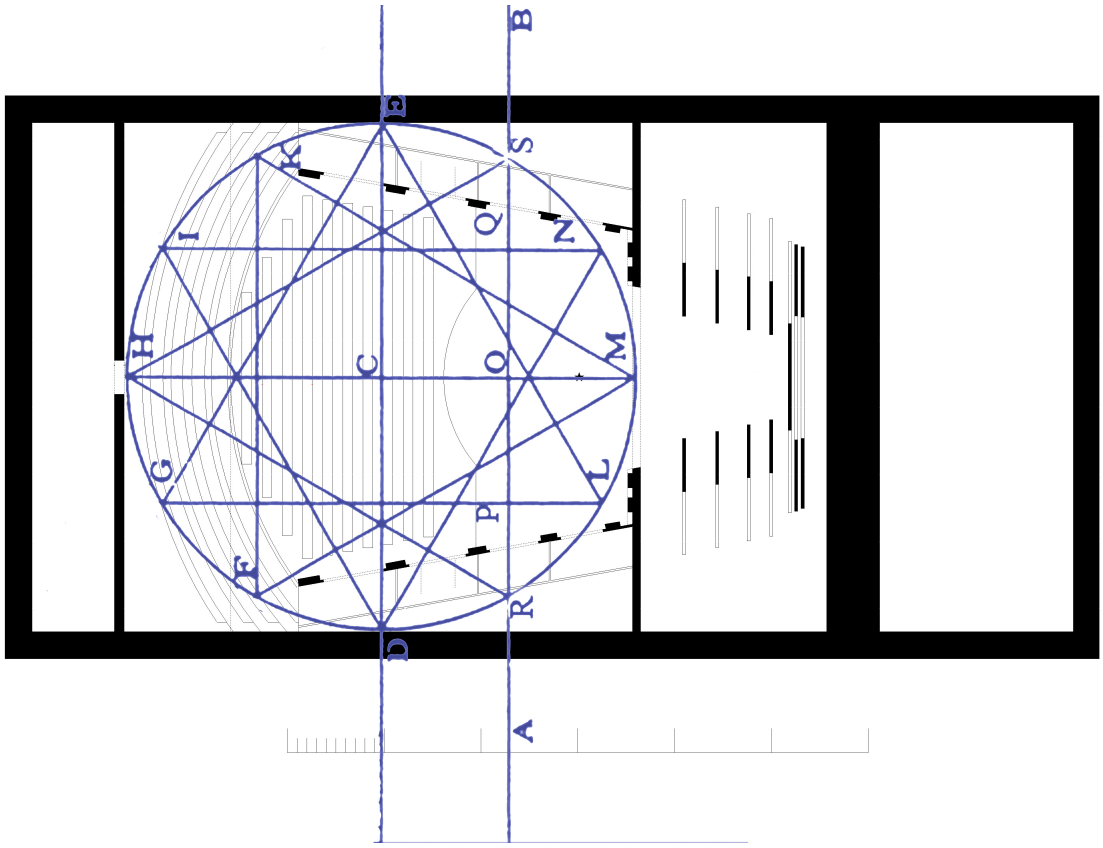


Figure 38. Plan with Vitruvian analysis. Fergusson 2018.

It is clear that this geometry describes a number of significant features of this plan. The lines MF and MK indicate the width of the curved section of the forestage, and the end of the auditorium fan, the points G and I indicate the diameter of the rear gallery benches, K and F the second benches and the intersection of HS and HR with ID and GE the front benches. The balcony fronts are indicated by the intersection of FK with IN and GL. The centre and edge of

the opening of the first arch is described by the points at which the side walls intersect with lines coming from D and E. The pit entrance is described by similar intersections. The line AB (which for Viruvius marks the *Scaenae*) on this plan sits within the main downstage actor entrances. The centre of all of the circles on the plan is the centre of the masonic emblem extending from point 'M'.

Figure 39. Reconstruction based on the Wren section – Fergusson 1999

The reconstruction of this space (Figure 39) demonstrates that the 1674 Drury Lane theatre was a small, intimate theatre with a genuine sense of shared space between actors and audience. In 1698, a visitor from France, Henri Misson described the interior, atmosphere and audience of the theatre:

> The Pit is an Amphitheatre, filled with Benches without Backboards and adorn'd and cover'd with green Cloth. Men of Quality, particularly the younger Sort, some ladies of Reputation and Vertue, and abundance of Damsels that haunt for Prey, sit all together in this Place, Higgledy-piggledy, chatter, toy, play, hear, hear not. Farther up, against the Wall, under the first Gallery, and just opposite to the Stage, rises another Amphitheatre, which is take up by Persons of the best Quality, among whom are generally very few Men. The galleries, whereof there are only two Rows, are fill'd with none but ordinary People, particularly the Upper one (Misson & Ozell:219-220)

There are few details known about the alterations which took place between 1764 and 1775 when Robert Adam remodelled the interior of the theatre. We do know that Garrick removed the audience from the stage and that there were some alterations to the boxes to recover the lost revenue. It is clear however from a comparison between the Adam engraving of the new interior and the computer reconstruction that while there have been significant alterations to the

arrangement of boxes, the **structure** of the building remained much as it was in 1674.

Figure 40. Adam engraving of the auditorium in 1775 (Leacroft, 1973:120) and computer reconstruction of the 1674 structure – Fergusson 1999

The Third Drury Lane Theatre

Figure 41. Interior of Holland's Theatre Royal Drury Lane - Fergusson 2018

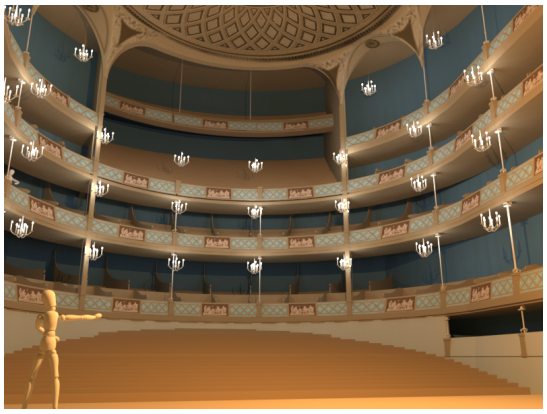
Following the demolition of the second Drury Lane Theatre, a much enlarged new theatre opened on 14th March to the apparent delight of audience:

> The New Theatre of Drury-lane was yesterday attended with a full audience, and among them a great number of fashionables. We do not doubt but the next performance will produce an overflow, as the elegance of the house, and the notes of the performers are very attractive… The Theatre is very capacious, and capable of containing 4000 visitors… and the general voice of the company, "it is a charming Theatre;" no expense has been spared to render it perfectly convenient; the accesses are the most perfect and commodious any Theatre ever had to boast. (The Times, 1794)

The interior of the new theatre (Figure 41) was indeed "commodious" and Holland made extensive use of the newly developed technique of casting iron to support four layers of balconies where the second Drury Lane had only two. Holland also made some significant alterations to the stage area. The stage doors traditionally used for all entrances (see Figure 39) were completely removed, as was the forestage which protruded into the auditorium.

While the audience may have found this a "charming theatre", the actors did not. Giving evidence to a House of Commons Select Committee in 1832[7], the actor William Dowton described the actors responses to the new theatre:

> Mrs. Siddons said "I am glad to see you at Drury Lane, but you are come to act in a wilderness of a place;" and God knows, If I had not made my reputation in a small theatre, I never should have done it here….All actors of that day, Mr. Charles Kemble, who was a young man as I at that time, can remember that Mr. King never went on the stage without cursing it, and saying that it was not like a theatre, and if Garrick was alive he would not act on it. (House of Commons, 1836)



[7] On this occasion, The Select Committee was hearing a case to authorise the licencing of additional theatres in London. Dowton spoke in support of the case and his evidence focussed on the benefit of smaller theatres.

Figure 42. A comparison of the view from the stage of the second and third Drury Lane theatres – Fergusson 2018

This was not the only critique of the new Drury Lane to evoke Garrick's memory, In his *Memoires*, the playwright Richard Cumberland also reflected on the new building:

> On the stage of Old Drury in the days of Garrick, the moving brow and penetrating eye of that matchless actor came home to the spectator. As the passions shifted and were by turns reflected from the mirror of his expressive countenance, nothing was lost; upon the scale of modern Drury many of the finest touches of his act would of necessity fall short. the distant audience might chance to catch the text, but would not see the comment. (Cumberland, 1807:385)

So while Holland's Drury Lane clearly fulfilled the requirements of the management, greatly enhancing revenue, Cumberland's comments suggest that the new building was out of step with the requirements of the actor (and indeed his own personal tastes). Cumberland's view was clearly not isolated, Dowton indicates that this criticism was widespread and as we have seen, Cibber too had felt that the original form (attributed to Wren) was far superior and that the enlargements were driven by financial concerns.

It would however be wrong to view this tension as a triumph of finance over art; Cumberland's observations are not an indictment of the inadequacies of architecture or acting style, simply a comment on their incompatibility. In fact he goes on to suggest that the new architecture encouraged a performance style that was not out of step with public tastes which were slowly evolving into a thirst for spectacle:

> The splendour of the scene, the ingenuity of the machinist and the rich display of dresses, aided by the captivating charms of music, now in a great degree supersede the labours of the poet. There can be nothing very gratifying in watching the movement of an actors lips when we cannot hear the words that proceed from them, but when the animating march strikes up, and the stage lays open its recesses to the depth of a hundred feet for the proscenium to advance, even the most distant spectator can enjoy his shillings worth of show. (Cumberland, 1807:384)

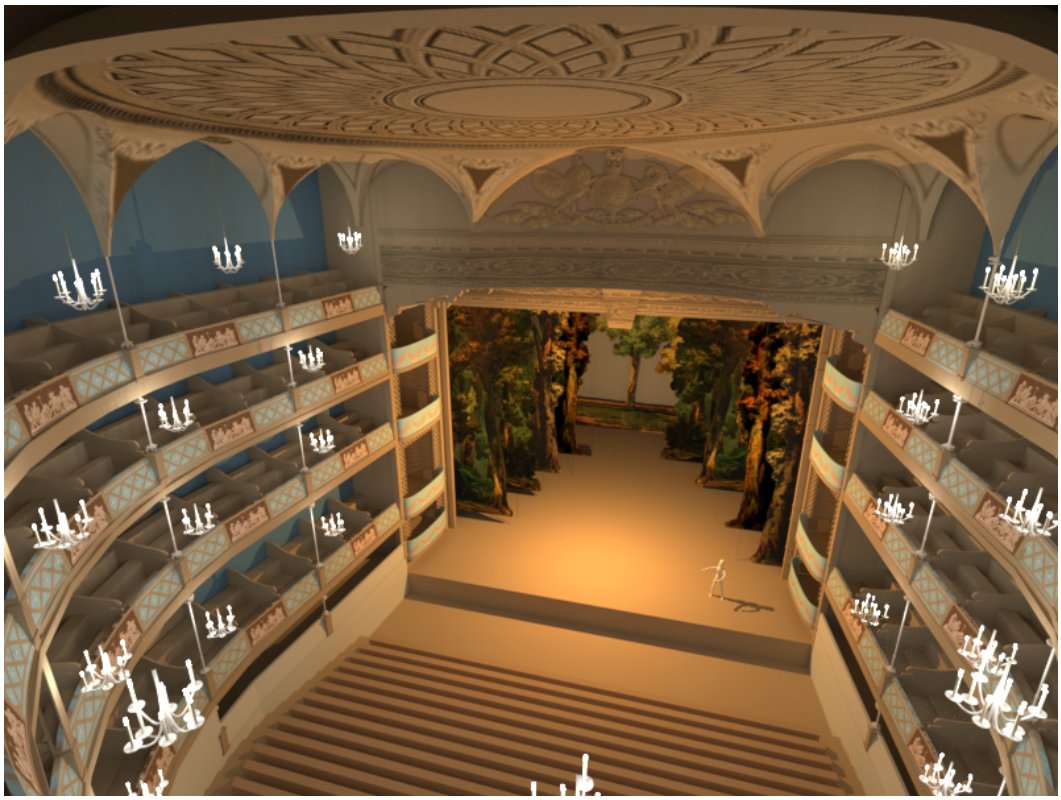


Figure 43. A view of the "distant" stage from the Balcony of Holland's Drury Lane - Fergusson 2018

So we must clearly not view Holland's building as having been driven solely by the financial demands of the then manager, Richard Sheridan. His designs for Drury Lane and Covent Garden (two years earlier) marked a new movement in English theatre architecture. Whether the actors liked it or not, the intimacy of the Georgian playhouse was giving way to the vast spectacle of the (European inspired) opera house, and Holland was at the forefront of this change.

In her doctoral thesis Anna Görel Garlick, in examining the desirability of occupying a stage box at Covent Garden describes a "privilege of remaining close to the actors" (Garlick, 1996). Although these seats clearly had a poor view of the scenic stage, their proximity to the forestage gave those seated there a direct relationship to the actors. But her identification of this as a "privilege" suggests something more about the function of theatre. It is easy to assume that the primary function of theatre is the presentation of a play for viewing by an audience, but the suggestion of the "privilege of remaining close to the actors" implies that viewing a play is not the sole 'primary' function of theatre, or at least that the act of viewing is neither absolute nor constant. In the continental

theatres of the same time, the forestage had long disappeared and the actor was placed firmly within the scene. For the continental audience 'viewing' was precisely that, but this was not the case in England. One of Cumberland's most telling reflections on the enlargements of Drury Lane and Covent Garden was his declaration that they would "be henceforward theatres for spectators rather than playhouses for hearers" (Cumberland, 1807:384). The English theatre at this time still looked back to Garrick's heyday, not out of a sense of sentimentality, but because the plays of the early Georgian period invited a different relationship between the stage and the audience.

The perseverance of the forestage and stage boxes in English theatre might then suggest a peculiarly English attitude to viewing. One where proximity was regarded as highly desirable. To occupy a stage box was to become part of the stage, and to be (to some degree) encompassed by the drama. The creation of a playing space flanked by audience is a theme recurrent in English theatre design[8] and such spaces discourage the audience from detaching themselves from the drama, both in terms of proximity and the fact that audience is inevitably visually framed as part of the drama. The sense of inclusion, indeed *communitas*, generated by this kind of audience arrangement (and apparent in Misson's description of the theatre in 1698) was strongly at odds with ideas of pictorial Romanticism which held sway over the stages of Europe. Here, the audience demanded a form of 'transportation' and in order to achieve that, it was necessary to see the stage as a self contained 'picture' which the audience could view individually and from an external point of view.

George Saunders in his *Treatise on Theatres* (1790) advocated the continental form of theatre and in his work, he frequently cites Francesco Algarotti's *Essay on the Opera* (1767). Saunders rejects the need for a forestage as "absurd" (Saunders, 1790:36) and explores the notion that theatre might (and indeed should) be viewed in new ways:

> The actors, instead of being so brought forwards, ought to be thrown back at a certain distance from the spectator's eye, and stand within the scenery of the stage, in order to make a part of that pleasing

[8] Earlier apparent in the circular form of the Globe and Swan, here in the form of stage boxes and in the twentieth century with the rise in popularity of the thrust stage

> illusion for which all dramatic exhibitions are calculated. But by such a preposterous inversion of things, the very intent of theatric representation is destroyed; and the proposed effect defeated. (Algarotti, 1767:97)

That is not to say that English audiences had no taste for pictorial Romanticism before the advent of the new theatrical form. On the contrary, in 1772 the Picturesque landscape painter Philip de Loutherbourg had approached Garrick with a new scheme for the scenery at Drury Lane (Baugh, 1990:29). In the following years, Louthebourg developed the quality of the staging at Drury Lane. It was however under Sheridan's management that he was to produce his finest work (Baugh, 1990:36).

The 1778 production *The Wonders of Derbyshire* was not only designed by Loutherborg but he was also given the freedom to define its form and structure and he produced a work which represented a radical departure from traditional shutter and groove scenery and a move towards the development of a stage picture that more closely resembled landscape painting. Indeed Loutherbourg based many of the settings on a series of paintings that he had produced of the Derbyshire countryside (and a lucrative book publication of the same title).

Figure 44. A comparison of Loutherbourg's engraving of *Peak's Hole* in Derbyshire (reversed) and his scenic model for the production (Baugh, 1990).

The settings for this production were a triumph, the dramatic content was not so well received:

> As an exhibition of scenes, this surpasses anything we have ever see: as a Pantomime we think it absolutely the most contemptible (*The Westminster Magazine* in Baugh, 1990:38)

Figure 45. Loutherbourg's scenic model for *Omai* – Kensington Gardens (Baugh, 1993)

It is a testimony to the importance of Loutherbourg's innovation that the production was a considerable success. He continued to work at Drury lane until 1781 when he retired from the theatre, quite possibly because of financial disagreements with Sheridan (Baugh, 1990:43). He returned to the theatre briefly in 1785 to stage a similarly spectacular production of *Omai or a Trip Round the World*. This pantomime loosely presented a fictional account of the journey of the prince (Omai) brought to England by one of Captain Cook's Officers in 1775 and featured a number of setting depicting south sea islands and one depicting Kensington gardens (Figure 45).

This design is important here because one of the very few surviving images of the interior of Holland's Drury Lane shows the theatre during a performance in 1775 (Figure 46). The process of engraving reverses the image created by the artist but if the image is reoriented as below, the resemblance between the setting and Loutherbourg's *Kensington Gardens* is striking. This cannot be the same set as the new stage is almost twice the size of the old, and Holland (in a letter to Sheridan) confirmed that "the scenes are and must be of course all new" (Sheppard, 1970:50) but the similarity suggests that at least some of these 'new' scenes were reproduced from existing stock. It is perhaps also significant that this is a scene designed by a painter with whom Sheridan was in apparent financial dispute and after he had left Sheridan's employ and joined the rival company (to their significant profit).

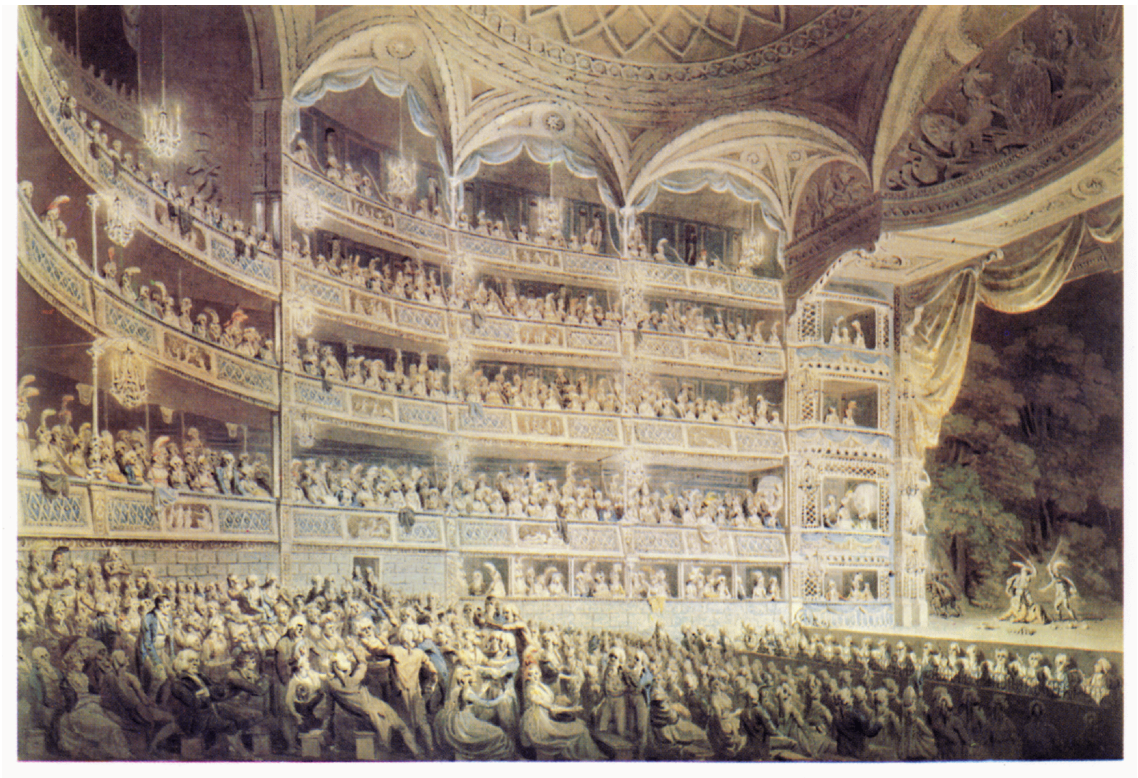


Figure 46. The interior of Holland's Drury Lane theatre in 1795 Engraving (reversed) by Edward Dayes (reproduced in Sheppard, 1970)

Whatever the origin of the design, it is clear from this image that this is a theatre in which this kind of scenic spectacle could be adequately framed. The requirement for the actors to stand within the scenery implied by Holland's architecture and explicitly articulated by both Algarotti and Saunders was a new one and carries a strong sense of Pictorial Romanticism.

After complaints from the actors though, the forestage and stage boxes were restored to the stage of Drury Lane. In the following years, they would be removed twice more by architects and restored once more by actors. The picture frame stage was finally permanently installed in 1822 by Samuel Beazely, this time to general acclaim. The implied change to the mode of presentation suggested by his architecture caused audiences to more widely acknowledge the cohesive stage image of the play, and the habit of using the architecture of the theatre as part of the world of that play eventually came to be regarded as ridiculous.

> Nor blame him for transporting from his floors
> The old offenders here, the two stage doors, -
> Doors which oft with burnished panels stood,

> And golden knockers glittering in a wood,
> That served for palace, cottage, street or hall,
> Used for each and out of place in all. (The Times, 1822)

It may have taken some years for English actors to become reconciled to this change[9] but the longevity of the new form is testimony to Holland's sensitivity to the impending change. We cannot of course overlook the fact that Holland may well have been working to his own agenda in introducing this theatrical form. Holland had obvious sympathies with the continent and he was also greatly influenced by the work of Victor Louis, and his theatre designs do, to some extent, represent a deliberate attempt to bring the continental theatre to England. Furthermore, if Cumberland's comments on the rising popularity of spectacle are correct, then it would appear that in this case, Holland was more in step with audience requirements than were the actors.

[9] It is interesting to note that Dowton's evidence to the Select Committee was presented as a balance to the testimony given by the much younger Edmund Kean (who's testimony immediately preceded his). Kean's testimony accepts that smaller theatres are useful in the provinces as 'schools' for actors but that the London theatres should represent the "perfection of the art" (House of Commons, 1836:89).

Reconstructing Process - Vlastilav Hofman's 1926 *Hamlet*

Context

The 1926 production of *Hamlet* is of particular significance in a range of contexts. It was Hiller's return production following a career hiatus occasioned by a devastating stroke in 1924 and it marked the beginning of a more reflective stage of his career (Burian, 1982:67). It was the production in which Hofman apparently shifted his focus from explorations of solid matter to explorations of open space (Burian, 2002:127) and has been further identified as significant in its use of screens to articulate that space (Burian, 2007). The significance of this particular production is further evidenced by the rich and varied original design material which has been preserved in a variety of archives (principally those held at Prague's National Theatre and National Museum and in the Burian holdings of Columbus State University).

Perhaps more importantly for this reconstruction, it is clear that this period was also particularly significant to Hofman himself. His 1926 essay 'My Evolution in Theatre' (reproduced in Nešlehová et al., 2004) was clearly written after his work on *Campaign Against Death* which opened in May 1926, just six months before *Hamlet,* and quite possibly while he was engaged in developing the design for this production (though he acted as scenographer for an astonishing six further productions in the intervening months). It is significant that in this essay Hofman makes a clear effort to 'reframe' his work as a practitioner, undertaking a retrospective review of his personal development as a stage artist, and identifying discrete (though often overlapping) 'periods' in his work. He concludes with a clear sense of artistic identity and direction. An exploration of his design process on *Hamlet*, considered in the light of his personal reflections on the 'demands of modern theatrical expression' (Hofman, 1926d:398) offers further insights into the conceptual development of this design and is evidenced through the surviving artefacts of the design process.

The principal purpose of this reconstruction then is to explore the extant artefacts of this production design with a specific aim of developing a clearer view of Hofman's process, rather than Hilar's vision, or any attempt to locate the final production within a broader performance history. For this reason, this

chapter will focus on the extant evidence of Hofman's process rather than Hilar's, which has been documented elsewhere (see Šormová & Otčenášek, 2011:61-79). It will use computer visualisation to explore the ways in which Hofman's process is evidenced by the remaining design artefacts of this production and will particularly focus on the ways in which his design **concepts** developed.

Taken together the overall sense conveyed by the available evidence is of a fluid production; A space sculpted by screens to create a changing architecture for performance. This fluidity is contrasted by the three 'monolithic' settings of the graveyard and ghost scenes which, in the context of the production as a whole seem to be out of place, and representative of a tension between concept and form in Hofman's designs.

In an effort to focus on the designer's process of conceptual development, this chapter deals only with the graveyard setting [1], described in Hofman's renderings as 'Cemetery' (Hofman, 1926b) and 'Ophelia's Funeral' (Hofman, 1926c). These renderings are supported by the scale model (Hofman, 1926a) and production photograph (Unknown, 1926b).

Reconstruction

While there is indeed an unusually comprehensive set of visual material available for this production, very little of it is of what might be described as of a technical nature. There exists a scale model apparently by Hofman himself (and a *post hoc* reconstruction of this model, prepared for exhibition) but this is the only material which can be used to establish measurements which might be considered in any way reliable. For this reason, it is necessary to engage with a mode of reconstruction which is somewhat different in approach than those explored elsewhere in this study.

I have previously identified a 'linguistic' mode of reconstruction, common in work carried out before 1985 (see page 31) in which analysis of visual and non visual material is essentially linguistic and the presentation of the outcomes of such analysis is presented as narrative with illustrations. This form of reconstruction

[1] Though the archive of practice also includes additional reconstructive material relating to the screens scenes and the scene with Polonius prepared for the *Shakespeare in Prague* exhibition.

is most clearly exemplified by the work of Deirkauf-Holsboer but is also evident to a lesser degree in the work of Richard Leacroft. Since the analysis in this form of reconstruction is principally linguistic, engagement with the material is primarily verbal in nature. Conversely, work carried out by Favro, THEATRON and in parts of the Italian Renaissance and Theatre Royal Drury Lane case studies of this work engaged with a mode of reconstruction which relies on a close analysis of extant plans and survey material. In this 'technical' mode of reconstruction, engagement with source material is primarily spatial in nature.

For *this* case study it has been necessary to engage with a mode of reconstruction that we might broadly term 'visual'. This mode is exemplified in Hann's work on Meyerhold's 1926 production of *The Government Inspector* (Hann, 2010a) and Fergusson's work on Appia's unrealised designs for Wagner's *Ring Cycle* (Fergusson, 1998). This form of reconstruction uses visual material to establish an implied (or in the case of photographs, actual) point of view and interpolate spatial information by constructing a three dimensional virtual model which corresponds to available two dimensional renderings. In this mode, engagement with material through interpolation could (in a strictly mathematical sense) be described as 'methodical', though the term 'holistic' better captures the true nature of this engagement.

Hofman's *Hamlet*

In *Leading Creators of Twentieth Century Czech Theatre*, Jarka Burian describes both Hiller and Hofman as "expressionists by artistic temperament" (Burian, 2002:126). Hofman himself was happy to apply the term to Hiller, but characterised much of his own early work as 'Cubist', though he renders this term ambiguous by describing his work in terms which seem to fall between the two modes:

> Exaggerated, broken lines, angled planes … subsiding perspective, angled, collapsing, twisted stairs, irregularity, gathering of mass, sharp angles, asymmetrical outlines, secret corners, contrasts of light and shadow. (Hofman, 1926d:392)

This ambiguity, no doubt driven in part by national and cultural sensitivities will be familiar to anyone engaged with work from this period, but if we needed to

confirm his **Expressionist** credentials we need look no further than his 1920 design for *Les Aubes* (Hofman, 1920) in which the stage space was dominated by towering architectural form and strong contrast. This was realised in the production through the use of strongly coloured (particularly blue and red) light which sculpted and articulated the stage space, but which was presented in the design sketches in the form of an overtly Expressionist imitation of woodcut art in the medium of brush and ink drawing on paper (Figure 47). The final scene featured an imposing ziggurat which seems to strongly prefigure Volbrecht's designs for Fritz Lang's *Metropolis* (1927).

Hofman identified his departure from these tendencies in his 1925 production of *Hippodamia* In which he "found it necessary to take a breather after Expressionism" (Hofman, 1926d:393), adopting instead a 'simpler line'. He identified this approach to his work as "Purist", and this is the mode in which he approached the 1926 *Hamlet*[2]. He articulated the values of this 'Purism' as "vertical harmony and an exaggeration of the space … painting gives way to architecture and sculpture" (Hofman, 1926d:393).

Hoffman' career is well documented, and evolutions in his preferred aesthetics are evident. What is less clear is the way in which he developed his ideas during his design process - as impressive and revealing as his essays and articles are, they are clearly an articulation of Hofman the artist and not Hofman the artisan. In order to develop any understanding of the ways in which Hofman developed visual concepts through the production process one can only explore this discourse through the choices, compromises and resolutions that are implicit in the extant artefacts of the design process. This task is then further complicated

[2] We should note that while this is the mode with which he is most clearly invested in his theoretical exploration, in 'My Evolution in Theatre', Hofman was also simultaneously pursuing an artistic approach which was broadly directed at Constructivist ideals. Most obviously in *Campaign Against Death* which immediately preceded the essay. Here we can see a series of functional platforms with emblematic detail which is at least in part reminiscent of Popova's vision for Meyerhold's *Magnanimous Cuckold*. This choice of artistic mode (apparently required by the director, Dostal) received some criticism by contemporaries who viewed it as a simple formal statement and not one which was suited to the dramatic content of the play (see Hilmera, 2004).

by the fact that at times Hofman adopted radically different stylistic approaches to his renderings, even on a single project.

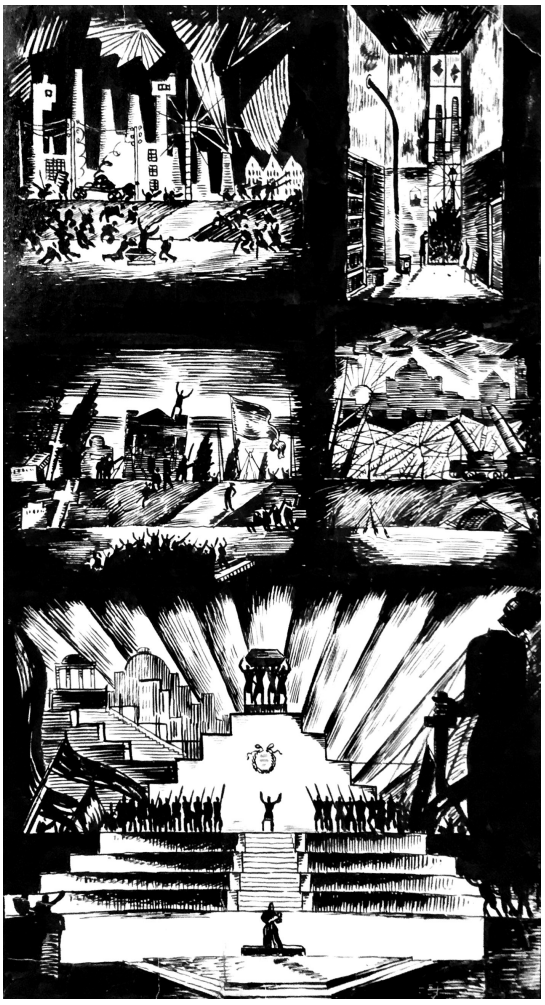


Figure 47. Five Set Designs for Les Aubes [Brush and Ink Drawing on Paper]. Národní Muzeum, Prague. (Hofman, 1920)

Fortunately Hofman's work has been extremely well preserved. There is a great deal of visual material available for the 1926 *Hamlet,* principally in the National Theatre Archive at Terezin and at the National Museum in Prague. Whilst this material is for the most part conceptual in nature (there are for example no technical drawings or illustrations developed for the benefit of construction staff, and none of the remaining illustrations bear the tell-tale marks of the scenic workshop) it does appear to represent most (if not all) of the design process. While there is no available evidence of initial sketch process there are comprehensive materials covering the various stages of realisation from initial

design concept to final production photographs. These materials may be organised into four ‘series’ of images:

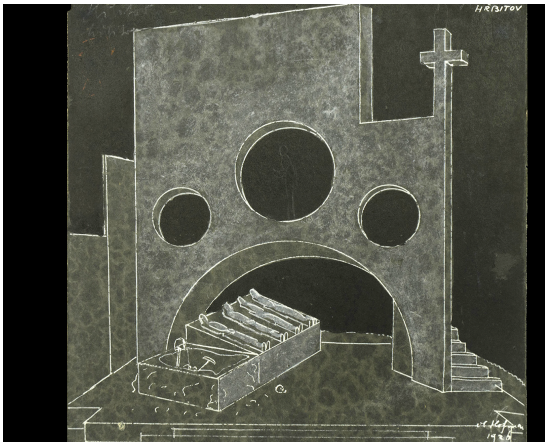


Figure 48. Design for Hamlet - Hřbitov (Cemetary) [Mixed Media on Black Paper]. Národní Muzeum, Prague. (Hofman, 1926b)

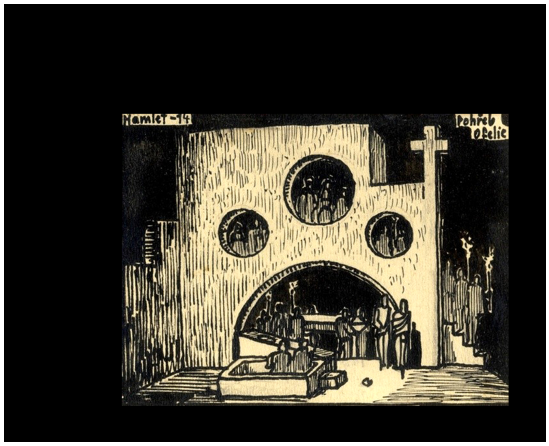


Figure 49. Design for Hamlet - Pohřeb Ofelie (Ophelia's Funeral) [Pen and Ink on White Paper]. Národní Divadlo, Prague. (Hofman, 1926c)

Figure 50. Design for Hamlet - Cemetary [Model Box]. Národní Divadlo, Prague. (Hofman, 1926a)

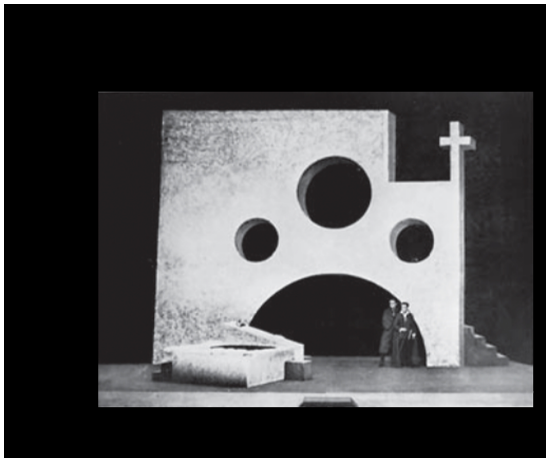


Figure 51. Hamlet - Graveyard Scene [Photograph]. (Unknown, 1926b)

The mixed media images (Figure 48) most likely represent the scenographer’s initial design ‘concept’. They are rendered on a black background, first in white ink outlines and then coloured with pastel and translucent paint (possibly gouache). These images are rendered with extraordinary artistic skill and care and have been exceptionally well preserved. They have been clearly highly valued by the artist and have not been subject to circulation among the

production team. They demonstrate a clear sense of artistic and stylistic vision which is unmediated by the limitations of available construction techniques (or indeed at times by the bounds of plausible reality).

The ink on white paper images (Figure 49) are presented as a storyboard of sorts, and include a clear sense of performance space, lighting and dramatic potential. The images are rendered with actors at 'nodal moments' of each scene (to use a term later coined by Caspar Neher[3]) to demonstrate a sense of the ways in which the space was intended to function in performance. This identification of key moments had clearly been an important part of Hofman's process from the outset, and is a technique he described in the context of his design for *The Hussites*:

> I was aiming to "strengthen the moment". From the whole spectrum of moods that reign on the stage, always the strongest – the one that lasts through the whole act was chosen. The artistic interpretation of one theatrical moment transformed into an unchanging image of the stage … An atmosphere always charged with one of the strongest moments of the many that make up the whole play. (Hofman, 1926d:398)

So clear is the dramatic narrative in this series of images that it is unlikely that they are a product of Hofman's vision alone but rather the result of a shared understanding of the production concept developed by Hofman and Hiller together. It is possible then that these images were produced after the commencement of the rehearsal process.

For the purposes of this reconstruction, the model box (Figure 50) should be regarded as a discrete 'series' of images that complement the design sketches and production photographs. It should also be noted though that there appears to be only one extant example from this series (the graveyard scene). It is not clear whether this is because other elements of the model have been lost or because other elements of the model were simply never made. Those pieces that do exist are certainly exceptionally well preserved in spite of their obvious fragility, and this again suggests that these are artefacts that have been valued. It certainly seems unlikely that they have been circulated or interrogated by

[3] See Baugh, 'Brecht and Stage Design: the Bühnenbildner and the Bühnenbauer' (in Thomson, 2006:267) for Egon Monk's description of Brecht's working practice.

scenic artists. While this might indeed suggest that this is the only model that was made (if the models did not leave the designer's studio we might expect to find at least elements of other settings preserved with them), and that it also suggests that this scene (or at least the scenic realisation of it) was a particularly important part of Hofman's process.

The apparent isolation of this model from the rest of the design process makes it difficult to establish the chronology of this series in relation to other evidence. Traditionally, the creation of a model box forms a relatively early part of the design process and this model is exceptionally well executed with a detailed texture and paint finish which are not evident in the final production photographs. Still, there is no sense that this is in any way a 'sketch' or experimental/provisional model. Yet the absence of any further evidence of model making on this project might suggest either that work on this series was abandoned at a relatively early stage or that this model was specifically created to explore the possibilities of realising *only* this scene. In either case, it would certainly suggest that Hofman viewed the graveyard scene as central to the play. The model box does however bear sufficient visual similarities with the final setting to support an assumption (with *caveats*) that it was created after the ink renderings.

The production photographs (Figure 51) are clearly the final set of renderings, they represent the scenographer's vision as it was realised in production. Again, there are a comprehensive set of photographs apparently taken from two different points of view (stalls and first circle). It is not clear whether these were taken during a single dress run although many of the images do include performers with the appearance of having been caught 'in action' rather than in a posed photo call. In some images there is a clear attempt to capture some of the more spectacular lighting effects while in others the lighting is more broadly demonstrative of attempts to document the setting which suggests that the photographs were not taken under performance conditions.

Reconstruction

In an effort to focus on the designer's process of conceptual development, this reconstruction deals only with the cemetery setting (Hofman, 1926b), 'Ophelia's

Funeral' (Hofman, 1926c), the scale model (Hofman, 1926a) and production photograph (Unknown, 1926b).

Stylistic differences between the series complicate processes of comparison. Visual perception is complex and requires significant acts of unconscious interpretation which can be extremely disruptive to processes of critical engagement. Passive attempts to reconcile stylistic differences between the series (and establish a sense of 'conceptual constancy') lead to a diminished perception of the **formal** differences. In this way, it becomes easy to interpret each distinctive image as a depiction of the same structure when there are in fact, profound differences between the structures articulated by Hofman at different points in his design process.

On encountering the images which communicate Hofman's concept we develop a sense of the structure that they demonstrate and once we have developed this familiarity we find it difficult to challenge our conceptual model. The operation of processes of conceptual constancy cause us to regard the difference between the images as purely stylistic. Markers which communicate **formal** difference are reinterpreted stylistically and we tend to modify our interpretation of the images to accept them as representations of the same stage space - but they are not.

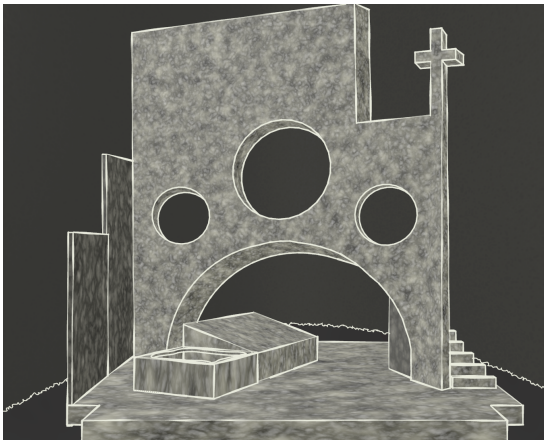


Figure 52. Reconstruction of Mixed Media series - Fergusson 2016

Figure 53. Reconstruction of Pen and Ink series - Fergusson 2016

Figure 54. Reconstruction of Model Box series - Fergusson 2016

Figure 55. Reconstruction of Production Photograph series - Fergusson 2016

In order to expose and address these issues of ‘critical disengagement’, the reconstructions were first undertaken in a way which attempted to capture the stylistic signature of the renderings of each of the representations of the scene (Figure 52 - Figure 55). This close observation of stylistic elements also greatly assists the processes of ‘visual’ (rather than ‘linguistic’) reconstruction as it supports spatial comparisons of the 3 dimensional model and the 2 dimensional image (Figure 56). The first stage of the reconstructive process was to establish the implied (or in the case of the two photographs, actual) point of view and equivalence of lens focal length. The point of view and approximate focal length of the camera which captured the image of the model box was known, but the details of the other images were established as part of the modelling process through a comparative exploration of lines of perspective - principally using the stage floor and steps as a guide.

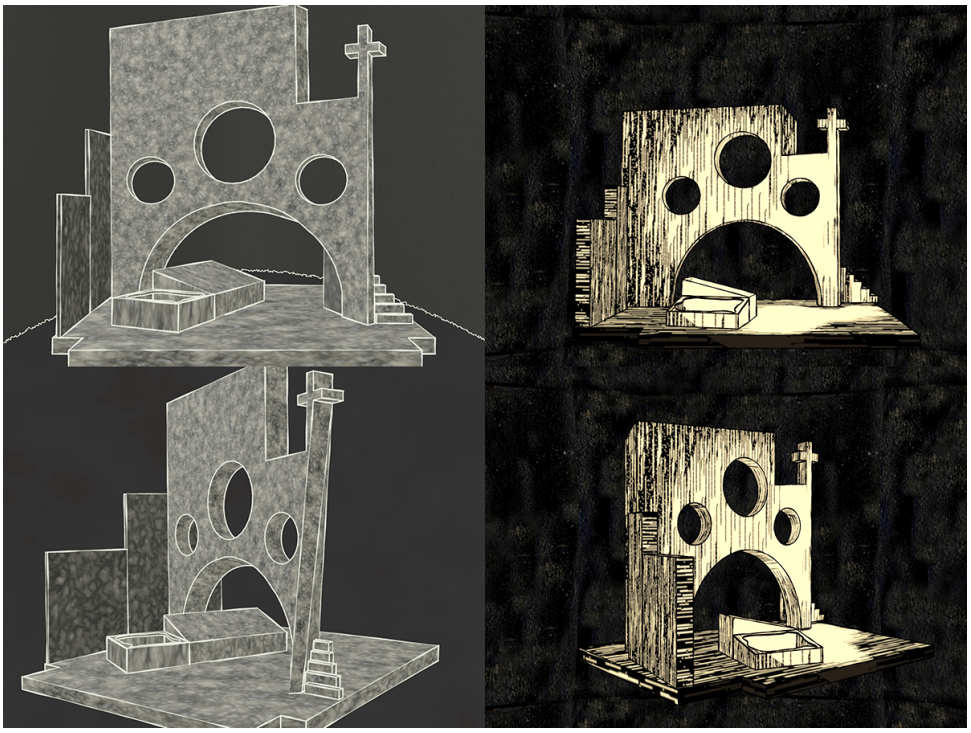


Figure 56. Reconstructions of illustrations explored as three dimensional models (Fergusson, 2016)

Once the point of view for the reconstructions was established, the images formed a guide for the placement and scale of the remaining elements (wall, stage right return, masking, cyclorama and graves). Once the four reconstructions were complete the problems presented by perceptual attempts to develop a sense of conceptual constancy were addressed by removing stylistic differences and presenting the models from a uniform point of view and in a neutral style - in this case simple line drawing (Figure 57). Formal differences can then be exposed through a process of 'morphing' between the different models, focusing the viewer on issues of difference rather than consonance[4].

[4] This is also explored as an animated sequence in the archive of practice.

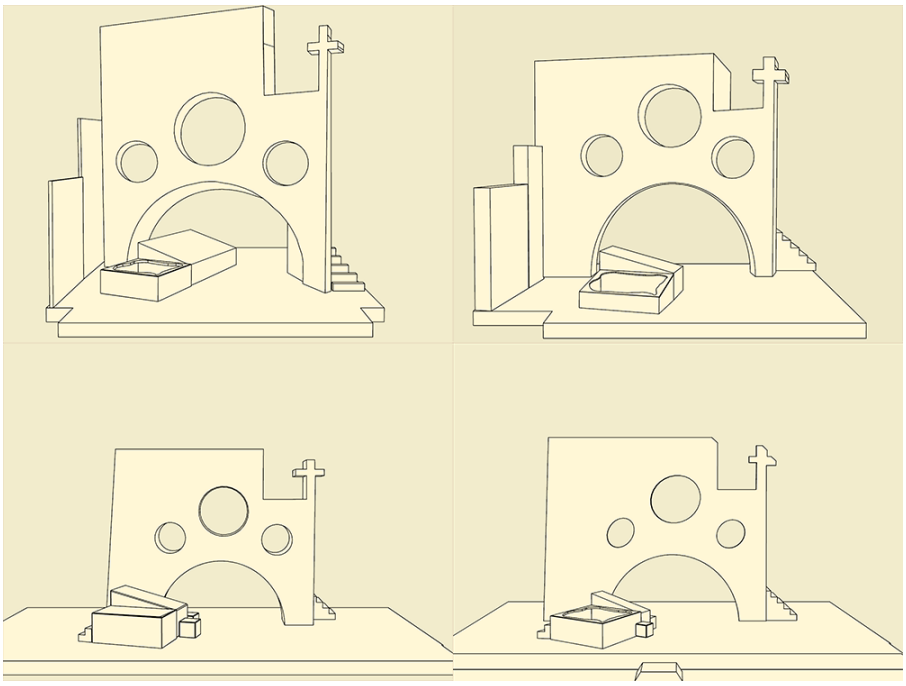


Figure 57. Neutral rendering of the set during development, showing formal differences (Fergusson, 2016)

Hofman's original design for the graveyard scene is profoundly different in style to almost all of his other renderings for this production. Given the views that he expressed in 'My Evolution in Theatre', it is particularly interesting that this difference takes the form of a clear debt to Cubo-Expressionism. The image itself is rendered with no fixed point of view. Instead it is formed from a collage of at least six **simultaneous** alternative view points. For the purposes of the reconstruction a point of view has been derived from the stage floor but it has been necessary to significantly deform other elements of the setting in order to capture this sense of simultaneity and conform to Hoffman's rendered image.

This distinctly Cubist view of the set is compounded by Expressionist distortions of height and depth and an overall exaggeration of vanishing point perspective. The virtual reconstruction demonstrates the extent of the distortion required to realise this 'capricious perspective', which is only truly apparent when departing from the implied point of view of Hofman's rendered image (Figure 56).

While many other extant images of this production demonstrate a vertical harmony and exaggeration of space (in line with Hoffman's Purist ideals), only the mixed media renderings of the graveyard scene and the scenes conceived

for the Ghost of Hamlet's Father retain this strong sense of Cubo-Expressionism.

Given the development of other scenes along Purist lines and the later revision of the graveyard scene, it seems likely then that these designs, aligned as they are to ideas that Hofman was in the process of rejecting in his critical work (possibly even as he was designing them), were among the first that he conceived. But this significant difference in aesthetic approach might also suggest that Hofman viewed these scenes (the graveyard scene and the two appearances of the Ghost of Hamlet's Father) as qualitatively different in the context of this production. The choice of the Cubo-Expressionist aesthetic then may have a significance beyond the manifestation of a developing stylistic approach.

In her examination of Meyerhold's deployment of stage cubism, Amy Skinner has identified that in the difference between referenced Cubist art and actual stage reality there exists a gap which invites analysis. "Similarities and differences between the canvas and the stage are fundamental … it is through these differences that the analysis functions" (Skinner, 2015:9). Skinner proposes that in Cubist staging there existed a tension between depth and surface that must be negotiated by the viewer (the fine artist may choose not to resolve this tension but the stage artist cannot) and this inevitably establishes a dialogue between realist and abstract concerns. Furthermore, the existence of this ambiguity requires a different form of engagement from the audience as the use of foreshortened (or in the case of the Hofman design 'capricious') perspective undercuts the notion of objectivity in viewing by challenging the belief that the spectator needs to occupy a position external to the performance in order to appreciate it (Skinner, 2015:56).

If the use of Cubist (or Cubo-Expressionist) aesthetics invites the audience to occupy the frame of the performance, the deployment of screens arranged with diminishing perspective (and reminiscent of neoclassical perspectival staging) has the opposite effect. Designs for scenes set in Claudius' home (Figure 58) and the garden demonstrate a clear sense of diminishing perspective which reinforces a sense that the stage image may only be resolved from a single fixed external and definitive point of view.

The choice of different aesthetic approaches then, might indicate that Hofman at least intended that the attitude of the audience should change during the performance. The adoption of a stylistic approach which invites challenges to the authority of presentation in scenes which deal with existential matters - with the exception of the famous ‘to be or not to be’ speech in which Hamlet was placed external to the scene in black ‘null’ space (see Šormová & Otčenášek, 2011) - takes on a greater significance.

Figure 58. Reconstruction of Hofman’s design for ‘other scene with the king’ (Fergusson, 2016)

Hofman had addressed this kind of acknowledgement of aesthetic **as** meaning in its own right in his 1913 essay ‘The stage shaped pictorially’ in which he makes a very clear statement that “the stage set as an independent expression, shaped by artifice, as effect for the sake of effect, is actually a work of art” (Hofman, 1926e:386). This sentiment is echoed in Bourriaud’s work *Relational Aesthetics*. Bourriaud claims that one can no longer consider the content of an artwork aside from its aesthetic as this represents an active choice by the artist which constitutes an invitation to dialogue with the viewer, and in this regard aesthetic should not be considered as ‘form’ but the more active ‘formation’.

> In observing contemporary artistic practices, we ought to talk of 'formations' rather than 'forms'. Unlike an object that is closed in on itself by the intervention of style and a signature, present-day art shows that form only exists in the encounter and in the dynamic relationship enjoyed by an artistic proposition with other formations, artistic or otherwise (Bourriaud, 2002:21).

If we are to accept that art is 'relational' in this way – a founding principal of dialogue – then Hofman's Cubo-Expressionist settings represent an invitation to engage with this dialogue, and in Bourriaud's conceptual model, this "inter-subjectivity does not only represent the social setting for the reception of art … but also becomes the quintessence of artistic practice" (Bourriaud, 2002:22). It is only through dialogue that form is granted productive status.

In the setting represented on the pen and ink rendering of the scene, Hofman has clearly rejected much of the Cubist intent of the mixed media image - though some Expressionist sense of exaggerated perspective remains. The virtual model of this rendering again reveals a setting which must undergo some contortions in order to achieve the reality of the original drawing, but those contortions are now much less pronounced and actually physically possible. So, while 'My Evolution in Theatre' suggests a move away from Cubo-Expressionism – a suggestion which is supported by his execution of other designs for this production – there are clear attempts to capture (or at least exploit) some of the Expressionist tendencies evident in the mixed media rendering in other series of images. Only in the model box are these tendencies completely absent.

The model does show painting clearly giving way to architecture and sculpture. But this 'monolithic' setting seems to be a comprehensive departure from the artistic and conceptual principals that underpin the rest of Hofman's process on this production. In the context of Hofman's essay, this artefact seems to be a rejected experiment. Indeed the absence of other model box elements suggests that this is perhaps genuinely the case – if a more complete model ever existed, this setting was apparently not part of it. It is clear that this model box captures none of the extended artistic commentary of the designer's two dimensional renderings - this setting is functional but it is not expressive.

It may be that in modelling the architectural form of the graveyard scene, Hofman discovered that any attempts to capture his original vision in three-dimensional form were ultimately futile (or at least very expensive). The contortions evident in the virtual model of the mixed media rendering were almost certainly beyond the budget (if not the technology) of the production, but the sense of shifted perspective was clearly so important to him (or possibly to Hiller) that it was retained and ultimately realised by way of a painted flat. It is clear from the production photographs that this pragmatic solution was not without compromise. While the upper windows retain a sense of painted depth, this has clearly been removed where ambiguous perspective was most directly brought into contact with living, three dimensional reality (in the acting space under the arch where there is no evidence of there being a painted 'return' as there is in the upper windows[5]). So while it clearly contradicted his Purist ideals, this use of painted scenery was the only solution available to Hofman to realise the more Cubo-Expressionist scenes of the graveyard and ghost scenes (where even the white lines of the mixed media rendering were retained in production, see Figure 59). It is worth noting that while the use of Cubist aesthetics in stage space can be difficult to negotiate, Hofman has addressed some of the more practical difficulties caused by the tensions between depth and surface by presenting his Cubo-Expressionist settings as a single unchallenged monolithic flatness in which the isolation offered by the black cyclorama becomes a critical element. Indeed the mixed media designs show that it is in these settings that the cyclorama has been most clearly articulated by the artist.

So it appears that Hofman has used this production to explore the possibility of developing a scenography that not only 'means' but also invites a reflection upon that meaning. Perspectival space framed by screens is suggestive of a performance environment in which meaning is fixed by an external view which the audience is invited to adopt, but scenes which deal with spiritual or

[5] It is clear from both storyboard sketches and narrative accounts that performers did appear in these windows during Ophelia's funeral. But the conflict between real actors and painted scenery is more significant where these actors are a focus of action and in front of the scenery. For the chorus at the window, it is possible to 'cheat' the perspective in a way which renders the conflict less problematic.

supernatural matters adopt a distinctly Cubist mode of presentation which openly invites interpretation (and suggest the possibility that individual views may differ). So while it may be a step too far to suggest that in his use of this aesthetic in the ghost and graveyard scenes, Hofman presents us with an extended metaphor for the death of scenic Expressionism, this is certainly a production in which Hofman presents us with a stage set that is indeed an "independent expression shaped by artifice" (Hofman, 1926e:386), a 'formation' that only really exists in the encounter between the audience and the production. In the context of Hofman's essay, we might see this as a production in which we can observe a stylistic evolution, a moment of change captured mid step. But in Bourriaud's terms the existence of the two modes is an essential part of this formation, because it is only in its dynamic relationship with other formations that an artistic proposition is granted productive status.

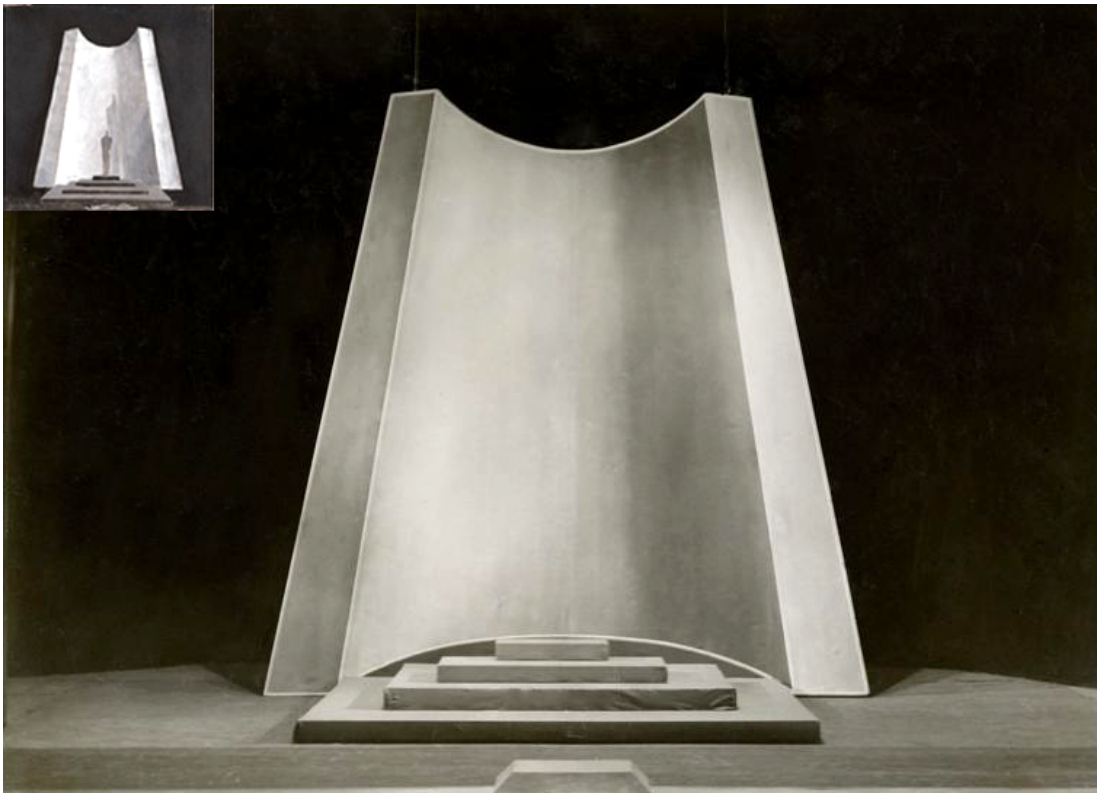


Figure 59. Hamlet - Ghost Scene [Photograph with inset mixed media design] (Unknown, 1926a)

So while the overall impression of this production is of a fluid space, sculpted by screens, it is clear that the juxtaposition of this mode with one which more explicitly acknowledges the productive role of the audience was an essential

element of Hofman's vision. So much so, that the deployment of this second mode has been the subject of an extended process of pragmatic compromise; and what we see in Hofman's process for the graveyard scene is a clear statement of Cubo-Expressionist intent, first tamed (in the storyboard) and then removed (in the model box) before being re-instated (in the production photographs) in a way which represents a pragmatic compromise between the designer's apparent intent and the technical requirements of stage realisation, and this is a process that we see (at least in part) reflected in this production as a whole.

Appendix A – The London Charter

DRAFT 2.1

7 February 2009

THE LONDON CHARTER

FOR THE COMPUTER-BASED VISUALISATION OF CULTURAL HERITAGE

PREAMBLE

While computer-based visualisation methods are now employed in a wide range of contexts to assist in the research, communication and preservation of cultural heritage, a set of principles is needed that will ensure that digital heritage visualisation is, and is seen to be, at least as intellectually and technically rigorous as longer established cultural heritage research and communication methods. At the same time, such principles must reflect the distinctive properties of computer-based visualisation technologies and methods.

Numerous articles, documents, including the AHDS Guides to Good Practice for CAD (2002) and Virtual Reality (2002) and initiatives, including the Virtual Archaeology Special Interest Group (VASIG) and the Cultural Virtual Reality Organisation (CVRO) and others have underlined the importance of ensuring both that computer-based visualisation methods are applied with scholarly rigour, and that the outcomes of research that include computer-based visualisation should accurately convey to users the status of the knowledge that they represent, such as distinctions between evidence and hypothesis, and between different levels of probability.

The London Charter seeks to capture, and to build, a consensus on these and related issues in a way that demands wide recognition and an expectation of compliance within relevant subject communities. In doing so, the Charter aims to enhance the rigour with which computer-based visualisation methods and outcomes are used and evaluated in heritage contexts, thereby promoting understanding and recognition of such methods and outcomes.

The Charter defines principles for the use of computer-based visualisation methods in relation to intellectual integrity, reliability, documentation, sustainability and access.

The Charter recognises that the range of available computer-based visualisation methods is constantly increasing, and that these methods can be applied to address an equally expanding range of research aims. The Charter therefore does not seek to prescribe specific aims or methods, but rather establishes those broad principles for the use, in research and communication of cultural

heritage, of computer-based visualisation upon which the intellectual integrity of such methods and outcomes depend.

The Charter is concerned with the research and dissemination of cultural heritage across academic, educational, curatorial and commercial domains. It has relevance, therefore, for those aspects of the entertainment industry involving the reconstruction or evocation of cultural heritage, but not for the use of computer-based visualisation in, for example, contemporary art, fashion, or design. As the aims that motivate the use of visualisation methods vary widely from domain to domain, Principle 1: “Implementation”, signals the importance of devising detailed guidelines appropriate to each community of practice.

OBJECTIVES

The London Charter seeks to establish principles for the use of computer-based visualisation methods and outcomes in the research and communication of cultural heritage in order to:

Provide a benchmark having widespread recognition among stakeholders.

Promote intellectual and technical rigour in digital heritage visualisation.

Ensure that computer-based visualisation processes and outcomes can be properly understood and evaluated by users

Enable computer-based visualisation authoritatively to contribute to the study, interpretation and management of cultural heritage assets.

Ensure access and sustainability strategies are determined and applied.

Offer a robust foundation upon which communities of practice can build detailed London Charter Implementation Guidelines.

PRINCIPLES

Principle 1: Implementation

The principles of the London Charter are valid wherever computer-based visualisation is applied to the research or dissemination of cultural heritage.

1.1 Each community of practice, whether academic, educational, curatorial or commercial, should develop London Charter Implementation Guidelines that cohere with its own aims, objectives and methods.

1.2 Every computer-based visualisation heritage activity should develop, and monitor the application of, a London Charter Implementation Strategy.

1.3 In collaborative activities, all participants whose role involves either directly or indirectly contributing to the visualisation process should be made aware of the principles of the London Charter, together with relevant Charter Implementation Guidelines, and to assess their implications for the planning, documentation and dissemination of the project as a whole.

1.4 The costs of implementing such a strategy should be considered in relation to the added intellectual, explanatory and/or economic value of producing outputs that demonstrate a high level of intellectual integrity.

Principle 2: Aims and Methods

A computer-based visualisation method should normally be used only when it is the most appropriate available method for that purpose.

2.1 It should not be assumed that computer-based visualisation is the most appropriate means of addressing all cultural heritage research or communication aims.

2.2 A systematic, documented evaluation of the suitability of each method to each aim should be carried out, in order to ascertain what, if any, type of computer-based visualisation is likely to prove most appropriate.

2.3 While it is recognised that, particularly in innovative or complex activities, it may not always be possible to determine, *a priori,* the most appropriate method, the choice of computer-based visualisation method (e.g. more or less photo-realistic, impressionistic or schematic; representation of hypotheses or of the available evidence; dynamic or static) or the decision to develop a new method, should be based on an evaluation of the likely success of each approach in addressing each aim.

Principle 3: Research Sources

In order to ensure the intellectual integrity of computer-based visualisation methods and outcomes, relevant research sources should be identified and evaluated in a structured and documented way.

3.1. In the context of the Charter, research sources are defined as all information, digital and non-digital, considered during, or directly influencing, the creation of computer-based visualisation outcomes.

3.2 Research sources should be selected, analysed and evaluated with reference to current understandings and best practice within communities of practice.

3.3 Particular attention should be given to the way in which visual sources may be affected by ideological, historical, social, religious and aesthetic and other such factors.

Principle 4: Documentation

Sufficient information should be documented and disseminated to allow computer-based visualisation methods and outcomes to be understood and evaluated in relation to the contexts and purposes for which they are deployed.

Enhancing Practice

4.1 Documentation strategies should be designed and resourced in such a way that they actively enhance the visualisation activity by encouraging, and helping to structure, thoughtful practice.

4.2 Documentation strategies should be designed to enable rigorous, comparative analysis and evaluation of computer-based visualisations, and to facilitate the recognition and addressing of issues that visualisation activities reveal.

4.3 Documentation strategies may assist in the management of Intellectual Property Rights or privileged information.

Documentation of Knowledge Claims

4.4 It should be made clear to users what a computer-based visualisation seeks to represent, for example the existing state, an evidence-based restoration or an hypothetical reconstruction of a cultural heritage object or site, and the extent and nature of any factual uncertainty.

Documentation of Research Sources

4.5 A complete list of research sources used and their provenance should be disseminated.

Documentation of Process (Paradata)

4.6 Documentation of the evaluative, analytical, deductive, interpretative and creative decisions made in the course of computer-based visualisation should be disseminated in such a way that the relationship between research sources, implicit knowledge, explicit reasoning, and visualisation-based outcomes can be understood.

Documentation of Methods

4.7 The rationale for choosing a computer-based visualisation method, and for rejecting other methods, should be documented and disseminated to allow the activity's methodology to be evaluated and to inform subsequent activities.

4.8 A description of the visualisation methods should be disseminated if these are not likely to be widely understood within relevant communities of practice.

4.9 Where computer-based visualisation methods are used in interdisciplinary contexts that lack a common set of understandings about the nature of research questions, methods and outcomes, project documentation should be undertaken in such a way that it assists in articulating such implicit knowledge and in identifying the different lexica of participating members from diverse subject communities.

Documentation of Dependency Relationships

4.10 Computer-based visualisation outcomes should be disseminated in such a way that the nature and importance of significant, hypothetical dependency relationships between elements can be clearly identified by users and the reasoning underlying such hypotheses understood.

Documentation Formats and Standards

4.11 Documentation should be disseminated using the most effective available media, including graphical, textual, video, audio, numerical or combinations of the above.

4.12 Documentation should be disseminated sustainably with reference to relevant standards and ontologies according to best practice in relevant communities of practice and in such a way that facilitates its inclusion in relevant citation indexes.

Principle 5: Sustainability

Strategies should be planned and implemented to ensure the long-term sustainability of cultural heritage-related computer-based visualisation outcomes and documentation, in order to avoid loss of this growing part of human intellectual, social, economic and cultural heritage.

5.1 The most reliable and sustainable available form of archiving computer-based visualisation outcomes, whether analogue or digital, should be identified and implemented.

5.2 Digital preservation strategies should aim to preserve the computer-based visualisation data, rather than the medium on which they were originally stored, and also information sufficient to enable their use in the future, for example through migration to different formats or software emulation.

5.3 Where digital archiving is not the most reliable means of ensuring the long-term survival of a computer-based visualisation outcome, a partial, two-dimensional record of a computer-based visualisation output, evoking as far as possible the scope and properties of the original output, should be preferred to the absence of a record.

5.4 Documentation strategies should be designed to be sustainable in relation to available resources and prevailing working practices.

Principle 6: Access

The creation and dissemination of computer-based visualisation should be planned in such a way as to ensure that maximum possible benefits are achieved for the study, understanding, interpretation, preservation and management of cultural heritage.

6.1 The aims, methods and dissemination plans of computer-based visualisation should reflect consideration of how such work can enhance access to cultural heritage that is otherwise inaccessible due to health and safety, disability, economic, political, or environmental reasons, or because the object of the visualisation is lost, endangered, dispersed, or has been destroyed, restored or reconstructed.

6.2 Projects should take cognizance of the types and degrees of access that computer-based visualisation can uniquely provide to cultural heritage stakeholders, including the study of change over time, magnification, modification, manipulation of virtual objects, embedding of datasets, instantaneous global distribution.

APPENDIX – Glossary

The following definitions explain how terms are used within this document. They are not intended to be prescriptive beyond that function.

Computer-based visualisation

> The process of representing information visually with the aid of computer technologies.

Computer-based visualisation method

> The systematic application, usually in a research context, of computer-based visualisation in order to address identified aims.

Computer-based visualisation outcome

> An outcome of computer-based visualisation, including but not limited to digital models, still images, animations and physical models.

Cultural heritage

> The Charter adopts a wide definition of this term, encompassing all domains of human activity which are concerned with the understanding of communication of the material and intellectual culture. Such domains include, but are not limited to, museums, art galleries, heritage sites, interpretative centres, cultural heritage research institutes, arts and humanities subjects within higher education institutions, the broader educational sector, and tourism.

Dependency relationship

> A dependent relationship between the properties of elements within digital models, such that a change in one property will necessitate change in the dependent properties. (For instance, a change in the height of a door will necessitate a corresponding change in the height of the doorframe.)

Intellectual transparency

> The provision of information, presented in any medium or format, to allow users to understand the nature and scope of “knowledge claim” made by a computer-based visualisation outcome.

Paradata

Information about human processes of understanding and interpretation of data objects. Examples of paradata include descriptions stored within a structured dataset of how evidence was used to interpret an artefact, or a comment on methodological premises within a research publication. It is closely related, but somewhat different in emphasis, to “contextual metadata”, which tend to communicate interpretations of an artefact or collection, rather than the process through which one or more artefacts were processed or interpreted.

Research sources

All information, digital and non-digital, considered during, or directly influencing, the creation of the computer-based visualisation outcomes.

Subject community

A group of researchers generally defined by a discipline (e.g. Archaeology, Classics, Sinology, Egyptology) and sharing a broadly-defined understanding of what constitute valid research questions, methods and outputs within their subject area.

Sustainability strategy

A strategy to ensure that some meaningful record of computer-based visualisation processes and outcomes is preserved for future generations.

Editor: Hugh Denard, King’s College London, 7 February 2009

Appendix B: Context for the Reconstructions

For a discussion of different approaches that have been taken in the various projects, see Modes of Process, page 77.

The 'Italian' Project

Theatre	Temporary Theatre Scaffold
Architect	Sebastiano Serlio
Completion	1539 (Published 1545)

Context

There have been a number of reconstructions of this material, most notably Richard Leacroft's 1984 reconstruction published in *Theatre and Playhouse* which includes physical model and isometric rendering. This material was also the subject of Hart and Day's 1995 computer reconstruction published in *Computers and the History of Art*.

Source Material

Serlio's Treatise of Scenes from *The Five Books of Architecture*:

Plates

Plan for the theatre scaffold
Section for the theatre scaffold
'Comic Scene'
'Tragic Scene'
'Satyric Scene'

Text

'On Perspective'

General Approach

This reconstruction has been undertaken a mode that combines technical and visual reconstructions. Serlio's text and technical drawings provide sufficient information to complete a model of the stage area an *cavea* but the scene designs are ambiguous (and inconsistent) in their presentation. The 'comic scene' clearly indicates a division between the forestage and picture stage but there real guidance to assist with the ways in which the offstage side of the flats might be resolved. Serlio's other settings do not even acknowledge a forestage.

The technical drawings then have been used to accurately establish the structure of the space and the stage space has then been interpolated from the information available in the scene designs.

Research Questions:

How might Serlio's drawings for the scenes be interpreted to present a stage setting? What is the extent of the impact of spectator point of view on the reception of the perspective 'illusion'?
Cultural Context Sebastiano Serlio's scheme, published in the second book of his *Architettura* in 1545 (Dover reprint 1982), six years after he constructed a temporary theatre in a courtyard in Vicenza, became one of the principal models for Renaissance theatre construction. The work was translated into English in 1611 and its influence on English theatre (particularly pre-commonwealth court theatre) is undeniable; John Orrell argues that Simon Basil's design for the hall at Christ Church, Oxford (1605) shows a clear debt to Serlio. The scenery on that occasion was designed by Inigo Jones and it is clear that he will have encountered Serlio's work in this context (Orrell, 1988:120). Orrell claims that both Basil's and Jones' experience of Italian theatre construction appears to be taken directly from the pages of Serlio (and later in Jones' case, Sabbattini and Parigi[1]). What **is** clear is that seventeenth century English theatre design owes much to the work of Jones and as such the written work of Serlio represents one of the most influential forces in English theatre design. With this in mind, many modern commentators have examined Serlio's treatise, most notably Kernodle (1944), Orrell (1988), Leacroft (1982; 1984) and the Centre for Advanced Studies in Architecture (Hart & Day, 1995), some constructing models of scaffold and scene.

Theatre	Teatro Olimpico, Vicenza, Italy
Architect	Andrea Palladio (completed by Vincenzo Scamozzi)
Completion	1580
Context While this theatre is certainly of significant historical importance, it has been subject to very little reconstructive practice – no doubt largely because the theatre remains intact and accessible. It was the subject of a geometrical analysis by O. B. Scamozzi in 1776 which establishes the influence of	

[1] In *The Human Stage*, Orrell examines Jones' contact with the Florentine Resident in London, Amerigo Silvetti, from whom he procured many of the Italian texts that he had heard about. Silvetti's correspondence notes that he passed a copy of Parigi's *Le nozzi degli dei* to Jones in 1638, Orrell has noted the influence of this work in Jones' designs for *Salmacida Spolia* (1641). A copy of Sabbattini's work on stage machinery is listed as part of the Jones library and the influence of this work is clear in Jones' staging. It is known that Jones did travel to Italy in 1613-4 and he certainly visited the *Teatro Olimpico*, but it is unlikely that he would have gained significant experience of theatre construction there.

Vitruvius' plan for a theatre on Palladio's design. The theatre was the subject of a 2002 reconstruction for THEATRON.

Source Material

Technical Drawings available for the Extant Theatre:

Plan
Longitudinal section
Transverse section
Plan for the scaenae

Photographic survey undertaken by the author in 2002

General Approach

This reconstruction has been undertaken in a technical mode. There exists sufficiently detailed material in the form of plans and site survey to complete an accurate reconstruction of this space. While this made the reconstructive practice uncomplicated, it also limited the need and consequently, scope for interrogation. This purpose of this reconstruction though has been to inform the project as a whole and in particular, the interpretation of Scamozzi's work at Sabbioneta.

Technical drawings have been used to establish the structure and decoration of the interior of the theatre.

Research Questions:

In what ways might an understanding of Palladio's *Teatro Olimpico* inform an understanding of Scamozzi's theatre at Sabbioneta?

Cultural Context

Palladio had been engaged in a close study of the work of the Roman architect Vitruvius and in 1556 had provided illustrations for Barboro's commentary on this work. His expertise in this area led the *Accademia Olimpica* at Vicenza (of which he was a founding member) to commission him to construct a setting for the performance of a celebration of Hercules (who was regarded by the Academy as their patron). The success of these celebrations was such that in 1561, the Academy commissioned him once again, this time to build a wooden theatre 'in the style of the Romans' inside Vicenza's Basilica (Rigon, 1995:24). This structure was founded on Palladio's research on classical forms. Significantly here Palladio rejected contemporary staging practice in favour of a 'permanent' *scaanae frons* (Rigon, 1995:28).

It was not until 1580 though that the Commune of Vicenza granted the Academy permission to build a permanent theatre. Palladio appears to have been waiting for such an opportunity as work on the building commenced almost immediately. It seems likely that Palladio's scheme was the product of his study of Vitruvius, his experience with the wooden structure he created for the Basilica (for which he also acted as theatrical director) and subsequent explorations through model making (Rigon, 1995).

Palladio died shortly after work on building the theatre started, but the availability of plans and models facilitated its completion in line with his design.

As complete as his plans for the building were, Palladio did not leave any indication of his intentions for scenic presentation. There is some suggestion that he had intended to deploy some form of *periaktoi* in the openings in the scaenae (Rigon, 1995) and he has included them within the stage openings of his illustration of Vitruvius. Ultimately though, the Academy accepted an alternative solution.

The inclusion of perspective street scenes in each of the openings was overseen by another local architect, Vincenzo Scamozzi. It is certainly the case that these did not form part of Palladio's plan as the additional land needed to accommodate them was purchased by the Academy after his death.

Theatre	Teatro all'Antica, Sabbioneta, Italy
Architect	Vincenzo Scamozzi
Completion	1590

Context

As with the work of Serlio, there have been a number of reconstructions of this material. The theatre is currently accessible and has undergone significant restoration projects but much of this work was undertaken in the late twentieth century and not all of it has been entirely sympathetic.

The most notable reconstructions are those by Richard Leacroft's (1984 published in *Theatre and Playhouse*) which includes physical model and the virtual reconstruction that forms part of THEATRON (2002).

Source Material

Scamozzi's sketch plan and section

Photographic survey undertaken by the author in 2002

General Approach

This reconstruction has been undertaken in a technical mode. While there is a plan and section by Scamozzi and a detailed photographic survey of the space, in places the plan is quite ambiguous. Two different scales have been used, and at times there seems to be some confusion (or at least inconsistency) in their use. The section is also significantly truncated where the draftsman has apparently run out of paper. The plan has been marked up with measurements, apparently by the same hand as the drawing.

The reconstruction is further complicated by the fact that a comparison with the building as it stands today shows some significant revisions after the completion of the drawing.

Research Questions:
What can be inferred from the ways in which the plan has been drawn and marked up?

In what ways might an understanding of this space be informed by Serlio's theatre scaffold and the Teatro Olimpico at Vicenza?

What might be inferred from the ways in which perspective has been deployed in this theatre?

Cultural Context

Scamozzi (1548-1616) was born in Vicenza and his training and early career were inevitably greatly influenced by the works of Serlio and Palladio. Much of his work is to be found in Venice and as such he can legitimately be regarded as a Venetian architect. He was engaged to complete the *Teatro Olimpico* in Vicenza on Palladio's death in 1580 where he was responsible for the addition of the perspective scenes. He completed a number of commissions in Padova but the theatre at Sabbioneta is located significantly further from his home region than any of his other commissions (with the exception of proposed renovations to Salzburg Cathedral, commissioned but ultimately not undertaken). At the time of the construction of the theatre at Sabbioneta, Scamozzi was also engaged on commissions at the Library of San Marco, Venice (1587-1596), the Villa Cornaro, Castelfranco (1588), the Villa Contarini, Padova (1590) and the Church of San Nicolò da Tolentino, Venice (1590-1595).

Vespasiano Gonzaga (1531-1591) was an accomplished writer, soldier and diplomat and a member of a cadet branch of the Gonzaga Family (Dukes of Mantua). Separated from the Ducal line by four generations, Vespasiano's inheritance remained unusually coherent. Attrition ensured that only one son remained in each generation to inherit the original bequest of land and the title of Count of Rodigo, granted to Gianfrancesco and Francesco Gonzago (the second and third sons of the principal line) on the death of their father (and Vespasiano's Great Great Grandfather), Ludovico III in 1478. In addition to this, Vespasiano also inherited lands from his mother Isabella Colonna. He was schooled first in Naples and then in Spain where he became a close advisor to Philip II.

In 1556 he began the project for which he is most well known, the construction of a new seat for his family, the town of Sabbioneta, which he constructed as a *citta ideale*. In 1577 Sabbioneta was declared an autonomous Duchy and Vaspasiano was granted a formal status more appropriate to his position. He shared a strong interest in the arts with his aunt (and step grandmother), Guilia Gonzaga who was responsible for his education while in Naples.

The Drury Lane Project

Theatre	Drury Lane Theatre
Architect	Attributed to Sir Christopher Wren
Completion	1674

Context

This theatre has been the subject of a great deal of debate and a number of reconstructions. The possibility of attributing the Wren section titled 'playhouse' (in the collections of All Souls College, Cambridge) was originally suggested by Hamilton Bell in 1913 and this contributed to much debate on the subject. Bell's suggestion is cited in Southern's model and illustrative reconstructions of 1948 and 1962, the scholarly disagreements between Edward Langhans and Mullin and Koenig (1966), Richard Leacroft's model and isometric reconstructions (1973) and Thomas' computer reconstructions (1996 and 1999).

Source Material

Images

Wren Section 'Playhouse' (1674)
Fronticepice to the Newcome edition of *Ariadne* (1674)
Ceiling designs by Robert Adam (1775)
Adam's engraving of the interior of the theatre (1775)
Map – William Lybourne (1686)
Map – Survey of London (1720)

Texts

Letter from Henri Mission
Colley Cibber's *Apology* (1889)

General Approach

This reconstruction has been undertaken in a broadly technical mode. The Wren section does contain a great deal of technical information about the theatre but the data available is significantly incomplete. In order to undertake a reconstruction of the space it is necessary to establish a ground plan and some information relating to transverse section.

The establishment of a ground plan represents a significant part of the process on this reconstruction. Information from the Wren section and the Adam ceiling designs has been used to interpolate information about the intended ground plan – it has been necessary to make the assumption that the underlying geometry of the plan has been based on circular rather than ovoid forms. The development of the plan is shown below. Transverse information has been taken from the *Ariadne* engraving (supported by the technical presentation of similar forms in the section). An *ad triangulum*

analysis of the proposed ground plan suggests that the underlying structure is sound.

Research Questions:

What was the nature of the space partially described by Wren's section 'play house'?

What evidence is there to suggest that this represents the scheme for Drury Lane 1674?

Cultural Context

On the night of 25th January 1672, The Theatre Royal Bridges Street was destroyed by fire, leaving the occupying company, the King's Men, homeless. A new theatre was built on the same site. The estimated costs for this new building vary between £3500 and £4400 (Sheppard, 1970:42). Although it is not known for certain who designed the new building, there is a body of evidence that indicates that Sir Christopher Wren was probably the architect. There is little pictorial material, and the evidence that we do have is largely circumstantial, but with careful consideration it provides a firm basis for this reconstruction.

The principle attributions to Wren originate from the memoir of the actor-manager Colley Cibber (1740) and Hamilton Bell's archival research in the Christopher Wren collection of All Souls College, Oxford, where he discovered an uncatalogued sectional drawing marked only 'play house' (Bell, 1913). Neither attribution can be regarded as definitive though. Cibber's claim is unambiguous but it was written some fifty years later and in old age:

> Spectators who may remember what Form the *Drury-Lane* Theatre stood in about forty Years ago, before the old Patentee, to make it hold more Money, took it in his Head to alter it, it were but Justice to lay the original Figure which Sir *Christopher Wren* first gave it (Cibber & Lowe, 1889:80-81).

Bell's attribution has received widescale acceptance, and Leacroft (Leacroft, 1973), Southern (1952; 1962), Mullin and Koenig (1966) and Thomas (1996) all effectively use his 1913 article to establish the authority of the Wren drawing even though the article itself only makes a tentative link based on the apparent size of the plot described by the section[2].

[2] Bell's suggestion is based on the assumed length of the building (there is a scale but it is not numerated) at 112-3 feet, this is consonant with the known dimensions of the plot for the theatre. Bell also notes the unusual termination of the stage area without pediment and identifies a similar form in the *Ariadne* engraving (Figure 35). It is also possible to estimate the width of the plot based on the pitch of the roof and the width of the visible exterior walls. The result also matches the known dimensions of the plot (58 feet). This figure though represents a significant conjecture and has not been used in the development of the plan.

Theatre	Theatre Royal Drury Lane
Architect	Sir Henry Holland
Completion	1794

Context

There has been relatively little analysis of this theatre. It is the subject of a 1973 isometric reconstruction by Richard Leacroft but beyond that, there appears to have been no attempts at any form of reconstruction.

Source Material

A complete set of Holland's original plans are available in the holdings of the Sir John Soanes Museum, London.

Daye's engraving of the interior of the theatre (1795)
Rowlandson and Pugin's aquatint of the interior (1808)
Engraving of the interior from Wilkinson's *Theatrum Illustrata* (1825)
All reproduced in Sheppard (1970)

Text – Henry Holland's letter to Sheridan after the opening of the theatre.

General Approach

This reconstruction has been undertaken in a technical mode. There exists sufficiently detailed material in the form of plans to complete an accurate reconstruction of this space. While this made the reconstructive practice uncomplicated, it also limited the need and consequently, scope for interrogation. This purpose of this reconstruction though has been to inform the project as a whole and in particular, to contextualise the response of the actors to the new theatre space.

Technical drawings and engravings have been used to establish the structure and decoration of the interior of the theatre.

Research Questions:

What was the precise nature of the change in playing space that produced such an extreme response from the acting company?

Cultural Context

In June 1791 the second Drury Lane theatre closed for the last time. Sheridan had widely publicised his plans to demolish the theatre and rebuild on a grand scale but it is clear that at that stage he had neither the funds nor the permission to do so:

> Nothing is yet finally settled concerning the rebuilding of DRURY LANE Theatre; - of course we are to conclude that Mr. SHERIDAN cannot make terms with the mortgages of the old House, and obtain their permission to pull it down, without finding sufficient security for rebuilding the Theatre (The Times, 1791b).

It was not until December of that year that Sheridan raised the £150,000 required to pay the existing debts and the costs of the new build, and secure the necessary permissions and land leases to complete the proposed project. The new theatre was to be "rebuilt on a most extensive scale, and with a superior style of architecture" (The Times, 1791a) and Sheridan engaged the architect Henry Holland to complete the work. Holland was by that stage in his career an extremely important figure with strong connections to the then Prince of Wales (later George IV)[3]. The work was completed in 1794.

[3] On completing work on the Royal Pavilion at Brighton in 1787, Holland was immediately engaged on a number of high profile and fashionable projects. In 1787 alone he was working on projects at Stanmore Park, Woburn Abbey and Pall Mall. By 1891 he had also remodelled parts of Whitehall, Berkeley Square and the Duke of York's residence near Harrogate.

Hofman's Hamlet

Production	Hamlet
Designer	Vslatislav Hofman
Performance	1926

Context

This production was a particularly important one in the development of Czech scenography. Šormová identifies in the director's interpretation of the text a departure from 'traditional' modes and a move towards the use of classical texts as a vehicle for social and political commentary. Burian evaluates the importance of this production design as one of a series of productions of *Hamlet* which seek to articulate dramatic space (both physical and temporal) through the use of moving screens and panels.

Source Material

There is an extremely rich and varied body of Hofman's original design material which has been preserved in a variety of archives (principally those held at Prague's National Theatre and National Museum and in the Burian holdings of Columbus State University).

Graveyard Scene:

Mixed media rendering on black paper
Ink drawing on white paper
1:25 Scenic model
Production photograph

'With Polonius' Scene:

Mixed media rendering on black paper
Ink drawing on white paper
Production photograph

'With the King' Scene:

Mixed media rendering on black paper

Screen configurations:

Various production photographs

General Approach

This reconstruction has been undertaken in a 'visual' mode. There are no extant technical drawing of this production, there is a model box but this only represents the design at a frozen moment in Hofman's process. The intention of this project has been to explore the ways in which Hofman's design developed through his process.

This form of reconstruction uses visual material to establish an implied (or in the case of photographs, actual) point of view and interpolate spatial information by constructing a three dimensional virtual model which corresponds to available two dimensional material.

Research Questions:

How might a close modelling of design artefacts assist in understanding the designer's process?

To what extent to differences in stylistic presentation of the artefacts of the design process prevent us from fully engaging with form?

Cultural Context

Frequently identified as one of the leading proponents of the Czech Cubist movement (also identified as 'cubo-expressionism'), Vlastislav Hofman was a dominant force in Czech stage design and scenography for the entire inter-war period of the twentieth century. Burian identifies Hofman's lengthy working relationship with the director Karel Hugo Hiller as particularly significant in the development of Hofman's practice in particular, and on Czech theatre in general:

> [Hiller was] the most forceful, innovative, far-ranging director-producer of large scale theatre in Czechoslovakia in his own lifetime. Hiller raised Czech theatre to world standards, and Hofman contributed in great measure to that achievement. (Burian, 2002:126)

Their working relationship lasted from 1919 when Hiller employed Hofman on the young architect's first stage endeavour, *The Hussites*, until shortly before Hillar's death in 1935 when they collaborated on Hiller's last significant production, *Mourning Becomes Electra* at the National Theatre in Prague in 1934.

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