Reconstruction, Replication and Re-enactment in the Humanities and Social Sciences

Edited by Sven Dupré, Anna Harris, Julia Kursell, Patricia Lulof and Maartje Stols-Witlox

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This book was realized with funding from the ARTECHNE project, a European Research Council (ERC) Consolidator Grant awarded to Sven Dupré under the European Union's Horizon 2020 research and innovation program (grant agreement No. 648718). Anna Harris's research contribution is funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program (grant agreement No. 678390).

Cover illustration: Anthea Walsh: Beady Eye, detail. Photo: Anthea Walsh, used with permission.

Cover design: Coördesign, Leiden
Lay-out: Crius Group, Hulshout

ISBN 978 94 6372 800 3
e-ISBN 978 90 4854 385 4
DOI 10.5117/9789463728003
NUR 694

Amsterdam University Press

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Acknowledgements

The idea for this book was conceived during a NIAS-Lorentz Workshop in Leiden in June 2017, and it was further developed in an authors' meeting at the University of Amsterdam in December 2018. We wish to thank all participants and hands-on session leaders who were involved in the NIAS-Lorentz workshop and kindly acknowledge the important contributions which the Lorentz Center, and its dedicated staff, made to this book. We would also like to thank the Rijksmuseum Boerhaave and the National Museum of Antiquities in Leiden, the Organ Park and the Atelier Building in Amsterdam, and the 4D Lab and the Conservation and Restoration Program at the University of Amsterdam, for generously hosting us. The realization of both meetings, and of this book, received further support from the ARTECHNE project, a European Research Council (ERC) Consolidator Grant awarded to Sven Dupré under the European Union's Horizon 2020 research and innovation program (grant agreement No. 648718). Our editor at Amsterdam University Press, Erika Gaffney, has guided us through the publication process with tact and efficiency. Jill Briggeman and Marleen Schans (ARTECHNE) have given invaluable editorial support without which this volume would not have been possible.

The Editors
February 2020

Amsterdam
University
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Introduction

Sven Dupré, Anna Harris, Julia Kursell, Patricia Lulof, Maartje Stols-Witlox

Abstract

Performative methods are playing an increasingly prominent role in research into historical production processes, materials, and bodily knowledge and sensory skills, and in forms of education and public engagement in classrooms and museums. Such methods, which we refer to as Reconstruction, Re-enactment, Replication, Reproduction and Re-working (RRR), are used across fields in the humanities and social sciences, from history of science and technology, to archaeology, art history, conservation, musicology and anthropology, among other disciplines. There is much to learn from interdisciplinary methodological reflection. RRR raises issues of truthfulness and accuracy, draws attention to process and performance as well as practices of documentation and facilitates communication with broader publics.

Keywords: truthfulness, accuracy, process, public, replica, ephemerality

Performative methods are playing an increasingly prominent role in research into historical production processes, materials, and bodily knowledge and sensory skills, and in forms of education and public engagement in classrooms and museums. Such methods, which we refer to in this book as Reconstruction, Re-enactment, Replication, Reproduction and Re-working (RRR), are used across fields in the humanities and social sciences, from history of science and technology, to archeology, art history, conservation, musicology and anthropology, among many other disciplines.

Throughout this book, a variety of terms are used in relation to performative methods. While the title focuses on Reconstruction, Re-enactment and Replication, these three are only a small selection of all the 'Re'-terms used to

Dupré, S., A. Harris, J. Kursell, P. Lulof, M. Stols-Witlox (eds.), *Reconstruction, Replication and Re-enactment in the Humanities and Social Sciences*. Amsterdam: Amsterdam University Press
DOI 10.5117/9789463728003_INTRO

describe activities in which researchers perform (past) practices.[1] Disciplines have acquired preferences for particular Re-terms. Reconstruction is the term of choice in conservation and restoration and in reference to digital or virtual reconstructions in archaeology; the 'replication method' is the point of reference in the history of science; and re-enactment seems to be the more common term in musicology and anthropology. The ways in which the Re-terms are used in the introduction and the different chapters of this book bear traces of these rich historiographical traditions. This also means that the use of specific Re-terms is not always consistent across the different chapters.

Despite the growing interest in performative approaches across disciplines, so far, reflection upon these RRR methods has largely remained within the disciplines. Yet, there is much to learn from interdisciplinary methodological reflection, especially with an eye towards considering more productively the generative potential of the challenges that come with the use of performative methods, challenges which are common to more than one discipline. In this book, an interdisciplinary group of authors bring their experiences of performative practices within their discipline in conversation with RRR methods in other disciplines. This, we suggest, offers deeper reflection on performative methods both within and across the disciplines. RRR raises issues of truthfulness and accuracy, draws attention to process and performance, as well as practices of documentation and facilitates communication with broader publics. We explore these themes which run through the chapters later in the Introduction, but first we look at how RRR methods have developed in archaeology, history of science and technology, musicology, and conservation and restoration, fields where RRR has a long tradition, as well as in anthropology, where it has been adopted more recently. While there are many more disciplines in which RRR methods have come to play a role, the mentioned disciplines have in common that their histories of using performative methods show traces of interdisciplinary cross-fertilisation upon which we can build.

1 Interdisciplinary reflection on the 're-' prefix is gaining momentum, see *An Errant Glossary*, ed. by Holzhey and Wedemeyer.

Histories of RRR in Conservation, Musicology, Archaeology, History of Science, and Anthropology

Ever since people started restoring Cultural Heritage objects, attempts to heal damage have resulted in some kind of reconstruction with the aim of remaking lost areas or even complete objects.[2] Such reconstructions predate reconstructing as a research method, to investigate past or otherwise unknown artisanal practices. Traditionally, such restoration-reconstructions were executed by artisans or artists working from a crafts or artistic background.[3] The gradual emergence of the restoration profession in the nineteenth and early twentieth century led to the development of professional guidelines, in which the field formulated ethical codes discussing the limitations and boundaries of restorative actions, as discussed in the chapter by Maartje Stols-Witlox in this volume.[4] The earliest evidence of reconstructions investigating methods and materials of past artists can be traced back to the eighteenth century. Jilleen Nadolny et al. placed the beginnings of reconstruction methodologies in the 1750s, when French connoisseur Count Caylus was investigating ancient methods of encaustic painting through experiments with historical recipes combined with scientific analyses, the results of which were published with co-author and medical doctor Majault as *Mémoire sur la Peinture a l'Encaustique et la Peinture a la Cire* in 1755.[5] Elsewhere, Nadolny recounted how excavations of Ancient sites like Pompeii fuelled enthusiasm for Antique painting and efforts to understand its techniques aiming to find more stable alternatives to the painting materials in use at the time. Interest in discovering the early history of oil painting, more in particular in the 'lost' paint binding medium of Jan van Eyck, played an important role in the publication of historical recipe books and manuscripts throughout the nineteenth century,

2 Thomas, in 'Restoration or Renovation', writes about Renaissance restorations and provides examples of restoration treatments that included far-reaching reconstruction or repainting. Campbell, 'The Conservation of Netherlandish Paintings', pp. 20-21, discusses a case in 1436 Tournai, when a wall painting in a building was copied on paper by a painter before demolition of the original, in order to have a record of the painting in case the decision would be made to reconstruct the paintings 'as they were before' (quote from Campbell).

3 See for example Brayer, *Conservation in the Nineteenth Century*; Sitwell and Staniforth, *Studies in the History of Painting Restoration*; and Conti, *History of the Restoration*, on the role of artists and artisans in early restorations.

4 The first conservation education programmes were set up in the 1930s and 1940s, first with the Courtauld Institute, followed slightly later by programmes in Austria (Vienna), Germany (Munich) and in Italy (Rome). See Nadolny, 'A History of Scientific Examination', p. 340.

5 Nadolny et al., 'Art Technological Source Research', p. 6.

for instance for two authors whose seminal works on historical materials are nowadays still consulted, Mrs. Mary P. Merrifield and Sir Charles Lock Eastlake.[6] Both are known to have tested the methods described in these historical sources through reconstruction.[7]

The interest in historical painting techniques in Germany led to the publication of additional historical sources in the series *Historische Quellenschriften für Kunstgeschichte und Kunsttechnik des Mittelalters und der Renaissance* (Vienna, Braumüller), and by German painter and art academy professor Ernst Berger, published between 1893 and 1919. Berger himself experimented with the preparation of historical paint recipes. The German periodical *Technische Mitteilungen* (1884-1944), established by chemist Adolph Wilhelm Keim in Munich, aimed to provide artists with reliable technical information and included articles describing reconstructions of historical methods.

Daniel V. Thompson (1902-1980), art historian, conservator, professor and chemical engineer, emphasized the role of craftsmanship in arts. He noted in his *Materials and Techniques of Medieval Painting* that 'technique means materials and tools in action', and described technical study of paintings including 'the recognition of those systematic methods which combine taste and knowledge and competence'.[8] Thompson's interest in craftsmanship extended to reconstructions of Medieval techniques on the basis of historical recipe sources and the study of paintings.[9]

Interest in early oil painting practice has not dwindled, for instance with the art historian Pim Brinkman's (1993) research in to Van Eyck's binding medium and the Impact of Oil project (2007-2015), both employing reconstructions based on historical recipes as well as on scientific data from painting investigations.[10] The combination of historical source research, painting investigation and reconstructions characterises the current approach to reconstruction within conservation and technical art history.[11] Ever since

6 Eastlake, *Materials for a History*; Merrifield, *Medieval and Renaissance Treatises.*

7 For example, Merrifield, *Medieval and Renaissance Treatises*, pp. liv-lv, ccxxxv, in her introduction discusses reconstructions of enamel paints as well as oil processing recipes.

8 Thompson, *Materials and Techniques*, p. 19.

9 Thompson discussed his approach in interviews. Oral History interview with Daniel Varney Thompson, 25 September, 1974 / November 2, 1976. https://www.aaa.si.edu/download_pdf_transcript/ajax?record_id=edanmdm-AAADCD_oh_212102, Checked on February 2nd, 2019.

10 See about the Impact of Oil project (Netherlands Organisation for Scientific Research, 2008-2013): https://www.nwo.nl/en/research-and-results/research-projects/i/19/3019.html. Checked on February 2nd, 2019.

11 The Art Technological Source Research Study Group, a working group within the International Council of Museums Committee for Conservation (ICOM-CC), brings together researchers

the introduction of the concept of 'historical accuracy' in reconstructions by Leslie Carlyle in the early 1990s, increasing emphasis has been placed on sourcing materials that are deemed appropriate for the time period studied.[12] More recently, other terms have been suggested to describe reconstructions that aim to approximate historical practices, such as 'historically informed' by Spike Bucklow and 'historically appropriate' by Carlyle.[13]

This terminological discussion has a direct equivalent in current RRR practices in the study of music. The historiography of such practices is intertwined with the peculiar role of performativity in music. Music cannot subsist without enactment of some kind. Musicology – in the roughly 150 years of its existence – has attached the prefix 're' to this enactment. Most often, musical re-enactments have been building on practitioners' foregoing calls and attempts to reconstruct the music of earlier times. The first performance of Johann Sebastian Bach's *Matthäus-Passion* after Bach's death by Felix Mendelssohn Bartholdy in 1829 is generally seen as a starting point. Mendelssohn's revival of Bach's music soon merged with canon formation, eventually resulting in a notion of classical music that coincided with eighteenth- and nineteenth-century composition.[14]

The limits of the canon were put into question by the young field of musicology. The founding figures of musicology, Philipp Spitta, Friedrich Chrysander and Guido Adler introduced Baroque music into the canon and eventually extended the scope to pre-modern composers as well. Their main occupation was to provide editions as reference objects for the discipline. Written musical notation became the focus of musicological scholarship, by the same token. Yet, the gap between the notating systems also drew attention to the fact that music had been performed under quite different and constantly changing circumstances. Musicologists felt the need to also bring to life the growing corpus of recovered written notation in musical performance. Adler's fundamental paper 'Scope, Method and Aim of Musicology' (1885) urged scholars and musicians to collaborate in the

within the arts domain who study historical sources, often in combination with/through reconstruction. http://www.icom-cc.org/21/working-groups/art-technological-source-research/ Checked on February 4th, 2019. Art history is a relative latecomer to the adoption of performative methods, but the discipline can build upon sustained methodological reflection which considers re-enactment as part of the toolbox of art history since Erwin Panofsky's 'Art History as a Humanistic Discipline' (1938). See Davis, 'Art History, Re-Enactment'.

12 See Carlyle's chapter in this volume.

13 Bucklow in Wrapson et al., *In Artists' Footsteps*, p. 26. See Carlyle's chapter in this volume on 'historically appropriate'.

14 See, e.g. Applegate, *Bach in Berlin*.

'restoration, re-working and performance' of historical works.[15] A parallel endeavour to place historical performance within music scholarship was Hugo Riemann's reviving of the *Collegium Musicum* tradition at Leipzig University after 1900. Many other universities followed the example, including Columbia University, in whose *Collegium* the most prominent critic of the later 'authentic music' movement, Richard Taruskin, played viola da gamba for many years.[16] The most influential example of this institutionalisation of reviving music was the foundation of the *Schola Cantorum Basiliensis* in 1933. Multiple nodes in the emerging network of musicians and scholars lead from these institutions to the Early Music movement that took shape after World War II in the Western world.[17]

If these activities mainly focused on the relationship between musical notation and performance, collecting and replicating historical instruments forms another thread in RRR and music. An early example is the cembalo designed for Wanda Landowska by the French company Pleyel in 1903. This instrument featured a strong bass register, unknown in the original instruments, but necessary for performance and recording in her times.[18] By that time, historical instruments had become collector's items. Instrument collections were reorganised and opened to the public. The growing knowledge about instruments reached beyond the community of musicians and scholars to buyers and forgers. The interested readership could be referred to the catalogues of famous collections, such as that of the *Gesellschaft der Musikfreunde* in Vienna, the *Musée instrumental du conservatoire royal de musique* in Brussels or the *Deutsches Museum* in Munich.[19]

Overseers of museum collections in particular held a fierce discussion over whether the instruments should be preserved in their current state or restored for playing. Curt Sachs, director of the Berlin collection, suggested integrating recordings into displays and engaged Landowska to play on a harpsichord that had come to the collection from the Bach family. Her phonographic cylinder recording of Bach's *Italian Concerto* from 1908 was

15 Adler in Mugglestone, 'Guido Adler's "The Scope"', pp. 1-21, quote on p. 17, translation slightly changed by Julia Kursell. On the history of musicology, see Auhagen et al., *Musikwissenschaft 1900-1930*, and more specifically on Adler: Martin Eybl, 'Guido Adler, die Denkmäler der Tonkunst in Österreich'.

16 Cf. Taruskin, *Text and Act*.

17 For example, Adler's disciples Josef Mertin and later Munich ordinarius Rudolf von Ficker, and the musicians Gustav and Marie Leonhard, Nicolaus and Alice Harnoncourt, or Paul O'dette. New light on the female participants in this endeavor has been shed by Mimi Mitchell, 'The Revival of the Baroque Violin', Unpublished PhD dissertation, University of Amsterdam (2019).

18 Eigeldinger, *Wanda Landowska*.

19 See, for instance, Ruth-Sommer, *Alte Musikinstrumente*.

meant to be played on site, but the wax cylinder recording proved too frail for this purpose and the idea was picked up only much later in a systematic way.[20]

After 1945 the notion of 'early music' came into use for explorations of a pre-classical repertoire. This was backed up by the formation of a lively community of musicians, listeners, scholars and instrument builders who fed their findings into the emerging market for digital recordings. The dry studio sound of the 1980s meant rethinking questions such as tempo and timbre in different terms than those of the nineteenth-century concert hall, if not necessarily more appropriate ones than the period practices. Today's notion of RRR rediscovers musicianship in new ways, connecting with the material turn in the social sciences and humanities.[21] Not only is the beginning of the movement nowadays an object of reconstruction under the header of 'historically informed performance practice', listening habits have also changed and keep changing dramatically, as the contributions in this volume will discuss.

As in conservation and restoration and music and musicology, RRR has a long and prominent history of use in the discipline of archaeology. However, while experimental archaeology has roots in the nineteenth century when archaeologists attempted to recreate the technologies of the past, it was only in 1979 that John Coles published a book on experimental archaeology, thus establishing the discipline of the same name.[22] In more recent years, Roeland Paardekooper and the EXARC network have done much discipline-formation work, from compiling bibliographies and documenting experimental archaeological projects to establishing experimental archaeology publication venues and writing histories of the discipline.[23]

In a special issue of *World Archaeology* on experimental archaeology, Alan Outram, professor of archaeological science, stated that one typical characteristic of experimental archaeology is that it is done in the field. He differentiated between experimental archaeology and experiments or tests in the laboratory, while specifying how they relate: 'A gulf is left between such laboratory work and how such processes may have been achieved in the past, with a limited range of materials, technologies and a lesser control upon the environment. Experimental archaeology comes into its own at this point. What has been learned in the lab can now be taken further; hypotheses

20 See Elste, *Meilensteine der Bach-Interpretation*.

21 See, e.g. the frequent references to music in Tim Ingold's *Making. Anthropology, Archeology, Art, and Architecture* (New York and London: Routledge, 2013).

22 Coles, *Experimental Archaeology*; Outram, 'Introduction to Experimental Archaeology', pp. 1-4; Reeves Flores and Paardekooper, *Experiments Past.*

23 https://www.exarc.net. Checked on March 31st, 2019.

can be tested in a range of environmental conditions that aim to reflect … "actualistic" scenarios."[24] To emphasise this open-air (as in, outside the controlled environment of the lab) character of experimental archaeology, Outram spoke of 'actualistic' experiments. The use of the term 'actualistic' also recognises the much-discussed issue with the 're'-prefix which misleadingly suggests that archaeologists can reconstruct the past exactly.

The aims and types of RRR methods in archaeology are diverse: from trying out archaeological techniques in actualistic scenarios and experimental investigations into formation processes of the archaeological record, to constructions testing the design of a building and research into technological processes and the *chaîne opératoire*. Especially in the latter categories of experimental archaeology, digital techniques have had a major impact. The latest development of data visualisation is the introduction of computer-generated techniques.[25] Three-dimensional models (3D), virtual reality (VR) and augmented reality (AR) animations are increasingly being used in reconstruction processes. These technologies also attempt to simulate ancient building techniques and visualise decisions taken by the archaeologists. Thereby, they allow archaeologists to explore processes that would otherwise remain hidden, or to answer questions that have never before been asked.[26] Archaeologists started to apply digital tools and 3D modelling in the early 1980s. Already in the 1990s they discussed the value and credibility of 3D modelling.[27] Today, many archaeologists experiment with the newest digital technologies for reconstruction.[28] These developments also embrace more disciplines, because the reconstruction of environments, architecture as well as material culture deals with (digital) data and artefacts from art history, history and heritage and memory studies.[29]

24 Outram, 'Introduction to Experimental Archaeology', p. 2.

25 On the history of archaeology: Stiebing, *Uncovering the Past*. An excellent overview of the history of reconstructing archaeological phenomena is provided by Piccoli, 'Visualizing Antiquity', pp. 225-59 and Moser, 'Archaeological Visualisation', pp.192-233.

26 Important publications that discuss the potential of 3D modelling: Hermon, 'Scientific Method', pp. 13-22; and for VR: Nick, 'Documenting and Validating', pp. 254-273; on the added value for ancient architecture: Lulof et al., 'The Art of Reconstruction', pp. 333-337.

27 For an excellent overview of the early rise of 3D modelling and its reception in archaeology: Lanjouw, 'Discussing the Obvious', pp. 1-13; on the resistance to this methodology in humanities: Ratto, 'CSE as Epistemic', pp. 567-587.

28 Since 2000, these new digital technologies have been unanimously embraced in archaeology; see Barceló et al., *Virtual Reality*. For discussion of their value and deception, see Posluschny et al., *Layers of Perception*.

29 On the use of 3D modelling withina wide range of disciplines: Opgenhaffen and Sepers, '3D Modelling', pp. 411-414 and Lury et al., *Routledge Handbook of Interdisciplinary Research Methods*.

Precisely to safeguard its methodology as scientific, experimental archaeologists have long distanced themselves from recreational and educational evocations of past life and technology by re-enactment groups dressed up in period costume.[30] However, in more recent years, some RRR projects have embraced closer connections to these practices. One example is the Iron Age Village in Sagnlander Lejre, a Historical-Archaeological Experimental Centre in Denmark, which was studied in the 1990s by an anthropologist who participated in the life of the Iron Age Village.[31] In such projects, volunteer and citizen non-archaeologists are involved in experimental archaeological research on equal terms with professional archaeologists.

Given its focus on past technologies, it is no surprise that in the twenty-first century experimental archaeology has connected with the history of technology and science.[32] In the history of the latter discipline, re-working, the reproduction or re-enactment of experiments is a methodological practice closely tied up with the issue of real versus thought experiment. A central question with which historians of science in the 1960s were concerned was whether Galileo performed experiments or whether his reported experiments were rather thought experiments. According to Alexandre Koyré, the imperfection of Galileo's instruments and experimental procedures did not enable any real experiments to have occurred. In the 1960s and 1970s, Tom Settle and James MacLachlan used experimental reproduction to show that Galileo did perform real experiments.[33]

Soon the question shifted from whether Galileo performed experiments, to how he acquired the skills to do experiments. Ever since, opening the black box of skill (or tacit or gestural knowledge) has been a central concern of experimental history of science, as conceived by Otto Sibum in the 1990s. Inspired by Falk Riess' addition of a laboratory course using replicas of historical scientific instruments to the physics teacher training programme at the University of Oldenburg, historian of science Sibum started reworking historical experiments using carefully reconstructed instruments.[34] While the history of experimental history of science is closely intertwined with science education, for Sibum, experimental history of science should also be self-reflective: experimental historians of science should be aware of the limitations of the reproductions of historical experiments. Experimental

30 Outram, 'Introduction to Experimental Archaeology', p. 3.
31 Holten, 'Engaging Experiments'.
32 Stauberman, *Reconstructions*.
33 MacLachlan, 'Galileo's Experiments' and Settle, 'An Experiment in the History of Science'.
34 Sibum, 'Reworking the Mechanical Value'.

reproductions generate historical possibilities and impossibilities, Sibum argued, but they are not able to tell what 'really' happened.[35] The rise of experimental history of science occurred at the time that the material turn took hold in the discipline, and historians of science became interested in instruments and the material culture of science more broadly.

History of science appears to have converged towards 're-working' as the term of preference to refer to performative methods in recent years, the term placing emphasis on process rather than product.[36] Nevertheless, experimental history of science has, and presumably will continue to use a wide variety of Re-terminologies. The only term which is considered misleading is 'replication', precisely because of its associations with its present-day scientific usage for repetition of an experiment to check or confirm the validity of prior results. The aims of historians of science and technology are quite different: 'When historians rework or reproduce a process or an experiment as a historiographical tool they are not replicating in these scientific [...] senses, but are instead seeking fresh historical information.'[37]

Sibum coined the term 'experimental history of science' in the 1990s, inspired by experimental archaeology, pointing to an interdisciplinary awareness of the use of performative methods. An important difference between archaeology and other disciplines (history of science, musicology, conservation) is the type of sources which are used in conducting research. Textual sources (such as recipes, musical scores, and experimental accounts, including lab books) are much more widely available in conservation, musicology and history of science than in archaeology; sometimes in the absence of instruments and experimental apparatus they are the only remains of past scientific and artistic practices. These fields require a close reading and engagement with both material culture and historical text sources. Performative engagement with texts has made researchers in these fields attentive to issues of language and questions of interpretation of terminology.[38] In recent years, this has resulted in projects in the history of science which take texts as their object of study, cooperating with conservators.

One example is Pamela Smith's Making and Knowing Project at Columbia University, which centres on a French, sixteenth-century manuscript in the Bibliothèque Nationale de France. Here, reconstruction serves the

35 Sibum, 'Experimental History of Science'.

36 Fors et al., 'From the Library to the Laboratory'.

37 Fors et al., 'From the Library to the Laboratory', p. 9.

38 By reconstructing alchemical practices, Lawrence Principe showed that the metaphorical language of alchemy (such as the 'Tree of the Philosophers') has its roots in actual experience in the laboratory. See Principe, 'Apparatus and Reproducibility'.

elucidation of historical texts, from the names of materials or processes to the distillation of taxonomies and how historical actors conceived of materials informing the processes of writing.[39] For Smith, reconstruction is a method of critical reading, assisting the understanding of the text and giving insight into the composition of the manuscript and the motivations and reasons behind writing. The treatment of texts as 'paper technologies', considered as embedded in material practices of reading and writing in the arts, is also the point of departure of the ARTECHNE project led by Sven Dupré. Adding yet another interdisciplinary reflection on performative methodology to the equation, inspired by the ethnographic experiment, ARTECHNE re-works recipes not only to reflect on the relationship between texts and practice, but more importantly, to gain insight into what artisans do with texts.[40] This brings us to the history of RRR in the discipline of anthropology.

Re-enactment methodologies have only more recently gained recognition in the work of ethnographers due to a number of developments in fieldwork methodologies. One of these is the increasing popularity of visual anthropology, whereby ethnographers retrace routes and revisit localities with cameras in hand. Sarah Pink and Kerstin Leder Mackley,[41] for example, argue that video re-enactments, whereby interlocutors are asked to re-enact their practices before a video camera, are a way to research and collaboratively apprehend, with research participants, aspects of their everyday life that are usually hidden. The Brazilian artist ethnographer Veridiana Zurita[42] explores this beautifully in her work in the Amazon, as she films families re-enacting scenes from their favourite soap operas; the insights into their lives are generated from the ways in which they adapt and add flourish to the scripts. Zurita's work highlights creative ways in which ethnographic fieldwork and artistic research are finding synergy; re-enactment methodologies are an experimental space where these approaches meet.

This performative turn in ethnographic methods can also be found in anthropological links with methods used in historical disciplines, especially oral history. For example, Paul Geissler and Ann Kelly[43] explored the methodological and theoretical potential of re-enactment during their ethnography of a research station in Tanzania to probe relationships between materiality, memory, place and affect. Geissler and Kelly used the

39 Smith, 'Historians in the Laboratory'.

40 Mann et al., 'Mixing Methods'.

41 Pink and Leder Mackley, 'Re-enactment Methodologies', pp. 146-154.

42 More information on the project can be found on Zurita's website: http://www.veridianazurita.com/index.php?/projects/televizinho/. Checked on April 4th, 2019.

43 Geissler, *Traces of the Future*.

now inactive field station as a site to bring together retired African and European workers to re-enact experiments and laboratory procedures. The ethnographers also re-enacted scientific method sections of papers written by researchers from the field station. They found that these performative methods rendered habitual movements, and the emotional labour of the scientific work conducted there into a productive conversation between the past and present.

As the music and language scholar Vanessa Agnew stated, 're-enactment's emancipatory gesture is to allow participants to select their own past in reaction to a conflicted present. Paradoxically, it is the very ahistoricity of re-enactment that is the precondition for its engagement with historical subject matter'.[44] The purpose of these re-enactments in Tanzania, Geissler and Kelley assert, was not so much to add tacit, embodied and relational dimensions of past events, as they suggest is the goal of re-enactment in other fields, but rather to 'shed light on the ethical and political tensions in our relationship with the past, and the experience of loss and decay – and to provoke and sense unexpected constellations, excess that moved beyond the script'.[45] These experiments are part of anthropology's shift since the 1980s from representation to presentation. This move opened up now common tensions in anthropology between authenticity and artifice, representation and desire, past and present.

As well as exploring re-enactment methodologies, anthropologists have also, perhaps more commonly, taken practices of re-enactment as a focus of their work. For example, Michaela Schäuble,[46] also using film and photography as a research tool, examines re-enactment and religious performances as sites of revitalising and negotiating tradition, heritage and cultural identity in Southern Italy. The anthropologist Lucy Suchman[47] researches the re-enactment and simulation of war in the Middle East with US soldiers, looking, for example, at the role of Hollywood in re-enacting war scenes for training, while Katherine Johnson reflects upon historiographic methods through her ethnographic study of a Jane Austen Festival.[48] Petra Tjitske Kalshoven[49] has written previously about Indian hobbyism, or Indianism in Europe, a practice that developed out of a strong fascination with Native American life in the eighteenth- and nineteenth centuries. The

44 Agnew, 'What is Re-enactment?', p. 328.
45 Geissler, *Traces of the Future*, p. 153.
46 Schäuble, 'Living History?', pp. 1-19.
47 Suchman, 'Configuring the Other', pp. 1-36.
48 Johnson, 'Rethinking (Re)doing', pp. 193-206.
49 Kalshoven, *Crafting the Indian*.

hobbyists themselves used ethnographies to base their re-enactments of North American Indian lifeworks, and in a move typical of anthropologists, Kalshoven draws upon the practices of her informants to reflect upon her own practices as a researcher.

Thus, the four main contributions of anthropology, as a relative latecomer among the disciplines to the topic of RRR, could be considered as the following. Firstly, the field contributes a great deal of reflexivity to RRR research with considered attention to researchers' own practices of researching, and offers insights into how the work of the researched can reflect upon the work of researchers themselves. Secondly, anthropologists help to expand the repertoire of fieldnote making and documentation of relevance to RRR methodologies across disciplines. Ethnographers are finding exciting new ways to extend fieldnote practices, using visual methods, or revitalising methods from other fields such as psychogeography and walking (see Jo Vergunst's chapter in this volume). Thirdly, anthropology is a field which is experiencing a close alignment with artists with regards to thinking through crossovers between artistic research and ethnographic fieldwork, including playful experiments with RRR. Finally, anthropology explores productive tensions between past and present realities through re-enactment, looking not at how to bring the 'past to life', but rather how performances may disrupt temporalities normally taken for granted.

This book

The disciplinary historiographies of RRR methods reveal what motivates researchers in different fields to introduce performative aspects, and provide insight into the way researchers have tried to come to terms with the limitations and problems associated with attempts to reconstruct environments, objects or processes. It also becomes evident that the emerging interdisciplinary dialogue on RRR methods has already started to enrich the potential of RRR methods in the fields of conservation, archaeology, history of science and anthropology. To foster this dialogue, in 2015, we organised a Netherlands Institute for Advanced Science (NIAS)-Lorentz workshop in Leiden, bringing together practitioners using performative methods across disciplines in the humanities and social sciences. The workshop involved lectures as well as hands-on laboratory workshops, walks and artistic experiments. This book builds on the collective, bodily and sensory experiences of the workshop. It is furthermore, to the best of our knowledge, the first book to bring together interdisciplinary reflections upon RRR methods.

This is an important step in the development of performative methods in research in the humanities and social sciences.

In this introduction, we highlight four themes which run through all of the chapters and could serve as the basis of future reflection: (1) Truthfulness and accuracy; (2) 'Re'-terminology: process or product; (3) Communication and the public; and (4) Documenting RRR practices and the challenge of ephemerality.

Truthfulness and accuracy

One of the starting points of the RRR practitioners in this book is their conviction that they cannot fully recreate the past, as our situatedness in place and time as well as our mindsets as researchers make it impossible to relive the past. In some fields, such as conservation for example, characteristic qualities of the object of study are assumed to have become lost with time and distance, as a result of ageing and degradation, or because of limited documentation. Words and images are considered insufficient to describe ephemeral aspects, variously referred to as 'tacit', 'implicit', 'gestural' or 'embodied' knowledge. Moreover, the traces we ourselves leave, our own 'footsteps' as researchers, increase this distance. The anthropologist Kalshoven puts this nicely when, in reference to the taxidermists she studies, she maintains that 'perfection is never really achieved: for the expert taxidermist, every mounted specimen is a rehearsal for the next one, making the practitioner move from one prototype to the next, which he or she hopes to be an improvement on the previous one'. The open-endedness of the process seems to capture a fundamental characteristic of RRR practices.

Carlyle uses the metaphor of the 'bull's eye', the centre of a target such as used in darts or archery, to clarify her approach to the 'accuracy' of reconstructions of historical paint recipes. Comparisons with actual historical paintings find their place in the centre of the 'bull's eye', and serve as a main point of reference for reconstructions that aim to be as historically accurate as possible, while acknowledging that accuracy can at best be approached. Archaeologists Patricia Lulof and Jill Hilditch add another aspect to this issue, drawing attention to the dimension of time. While a painting was (often) created in a relatively short time, archaeological sites may have grown and changed over centuries. Hence, a clear 'target' in time may not exist.

Interestingly, while some fields struggle to define and bridge the distance to the past, Kalshoven emphasises its positive effects: while 'the act or thing being replicated (or reconstructed or re-enacted) will never be quite the

same as the emulated act or thing on which it was supposedly modelled', this situation creates 'opportunities to undermine or critique underlying models and ideologies'. Others, like the historian of science Sibum, emphasise that 'it is important to understand that reworking past experiments by means of performance is not an attempt to find out how it really was'. It is evident that instead of an inherent weakness, the impossibility to replicate the past is seen as constructive. RRR offers researchers the opportunity to create the conditions that allow them to raise interesting questions about past processes or objects of study. In musicology, sound is an extremely elusive target. In their chapter on historical organs, Peter Peters and Julia Kursell therefore focus on learning the processes involved, instead of imitating 'site-specific' solutions, while Hans Fidom emphasises the importance of *process* reconstruction to signal his reservations regarding the possibility of recovering or replicating a past sound concept. The aim of process reconstruction, according to Fidom, 'was not to build yet another "Bach-organ" but to conceive a sound world that would fit historically informed performances of Bach's music as well as inspire making new music'.

The choice for a specific Re-term is directly connected to reflections on temporalities of RRR research and on its historicity, recognising the impossibility of walking in the streets of the past. Leslie Carlyle opposes historically accurate reconstruction to an older pedagogical practice in conservation to which she refers as 'reproduction', that is, the pedagogical practice of copying (or replicating, one might say) the image of a painting to understand how it was created. Instead, 'reconstruction' uses historically appropriate materials to 'produce historical models at the material level, not only in terms of surface appearances'. Nevertheless, historians of science continue the use the term 'reproduction' to draw 'attention to the final products and the means of their production, working to explain the underlying processes or reactions involved as well as the material circumstances that help shape these products'. While Fidom introduces the term 'process reconstruction', the anthropologist Jo Vergunst questions the use of the 're'-prefix in 're-enactment' alltogether to complicate the 'simple divide between originality and copying', opposing acting and enacting to 'mechanical replication'.

'Re'-terminology: process or product

The term 'process' is indeed central to RRR practices. Researchers employ RRR to learn about skills, workshop choreographies, and thus the workings of past processes. Similar to the *chaîne opératoire* as it is called in archaeology

(see Hilditch in this book), Peters and Kursell discuss the importance of process reconstruction in the North German Organ Research Project: 'recovering the sound of historical organs required relearning artisanal building techniques that were displaced by modern building techniques over a century ago'.

As evident from Sibum's account of a re-enactment of the paddle-wheel experiment of James Joule, re-working can give insight into the operative knowledge and skill of this scientist, the complexity of the experiment, the likely set-up in the laboratory, and the choreography of actions shows that the experiment required an assistant; all aspects that did not make it into Joule's scientific publication. Sibum emphasises that 'only the performance of experiment can provide access to a working knowledge that existed in the scientific laboratories, artisanal workshops and studios of the past'.

In other disciplines, the balance might shift more towards product than process. Paintings conservator Stols-Witlox relates this shift to her profession, writing that 'the profound way in which our aim to be invisible in conservation interventions is integral to the profession, may in fact be why in conservation terminology to describe methods that replicate artistic processes equally focuses on the object'. This brings us to the importance of 'Re'-terminology. Roughly speaking, a distinction is evident between two groups of terms, those that relate to process and those that are result-driven (e.g. replication of an object or an architectural structure such as a house). This distinction in focus (process or product) relates to the aim of the research, but is also to a certain extent discipline-guided.

However, several authors also adopt other terms in addition to the more standard terminology used in their disciplines. For example, RRR methods in conservation typically have more object-focused aims. Carlyle uses 'reconstruction' in accordance with the tradition in conservation and restoration, but she also refers to re-enactment when she discusses the less commonly studied ways that oil paint behaves under the brush or palette knife during application. The archaeologist Lulof also conceives of digital reconstructions as incorporating 're-enacting' building processes. Fidom, Kursell and Peters adopt the term 'process reconstruction' to differentiate their approach from the more standard re-enactments in music. Process reconstruction is 'more than simply re-enacting historical craftmanship,' as they write; more also than the reconstruction of a material object – i.e. the musical instrument or the organ – as sound is also involved.

However, even when the focus is on scrutinising process or *chaîne opératoire*, performative methods can still entail the making of a (virtual) reconstruction of an object (on the basis of excavated archaeological remains

as Lulof describes) or a replica of a scientific instrument by historians of physics Sibum and Peter Heering in their respective chapters in this book. While Sibum creates *replicas* of historical scientific instruments in order to *perform* past experiments, he insists on the term 're-working' and categorically objects to the use of 'replication' to refer to his method to avoid confusion with replication in science (as discussed above). He also prefers 'reworking' above 're-enactment', because he wants 'to indicate that every performance of an experiment is a unique event and certainly different from the original one. Hence, even if 'reworking' is striving for re-enactment of a past experimental performance the term 'reworking' ensures not to think that repetition, replication or re-enactment is possible. At the most, by means of performance of experiment we are able to reconstruct past events.'

Despite reservations towards 'replication', Kalshoven, among others, uses the term 'replication' which she conceives as 'the skilled act of copying a thing or a practice'. Rather than a reproduction of the past, she believes that 'replication' can be given a playful and future-oriented twist. 'After all,' Kalshoven reminds us, 'to replicate, from the Latin "again" and "to fold", is the practice of folding anew, once more, yet again.'

Communication and the public

RRR methods have not only offered insights into research questions across the disciplines represented in this book, but they also offer a way in which to engage with broad audiences, whether in classrooms, museums or other public settings. Thijs Hagendijk et al.'s chapter offers one of the most explicit examples of the opportunities for RRR in the classroom. Their plea is for more hands-on history, supported by the rich insights from students into crucial yet often ignored scientific practices such as failure, improvisation, trial and error. When students made things with their hands – a single bead-lens microscope for example – they were able to be playful with science in a way that other kinds of teaching do not allow, and in a less hierarchical setting than is commonplace in universities. As Hagendijk, Heering, Principe and Dupré write, 'the power of RRR approaches in the classroom is to create collaborative learning environments in which students learn together and alongside their teachers'. Through RRR, students and teachers make historical knowledge together.

RRR in the museum is discussed by Stols-Witlox, who outlines the possibilities of digital reconstructions of art objects in the museum context, as does Lulof, through the example of the disputed reconstruction of a building which is on display at a local museum close to the archaeological

site. Kalshoven studies taxidermists who made objects both for display in museums as well as for teaching.

Anthropologist Vergunst discusses many different audiences for the walks in his chapter: the RRR community, postgraduate students and the general public in Aberdeen. The material accumulated in RRR research can also lead onto public projects through the building of databases – databases of recipes for further research by others, in Carlyle's case, or databases for building reconstruction in Lulof's.

Documenting RRR practices and the challenge of ephemerality

Sibum describes one of the strengths of RRR, writing that with a 'dynamic conception of embodied knowledge that is bound to the performative actions of the researcher or collective, we are able to grasp those cultural repertoires of action which are essential for the formation of this experimental knowledge but usually escape the historian's attention because these belong to different worlds of sense which are often described as non-verbal or oral knowledge traditions'. But how can we document these observations? As RRR scholars, we find ourselves facing the very same challenge of documenting embodied and material work that results from our practices, as faced by the scientists, artisans, musicians or other makers we study. How can we find ways to trace bodily engagements, material forms and hands-on learning?

In this respect, ethnographic note-taking practices are of particular interest. In his chapter, Vergunst discusses the imaginative possibilities of mapping, and the methods of psychogeography, next to fieldnotes in the traditional sense. He points to the maps that anthropologists make, but hardly publish in their fieldnotes. For Vergunst, these methods of documentation highlight how ethnography is a practice, not a methodology; it is a form of inquiry and observation and a way of going about the world that we are part of. Kalshoven offers a form of documentation that aligns with Vergunst's approach. In her ethnographic study of taxidermy, Kalshoven commissioned an artist to work with her on shared interests (see front cover). The final result was not only an intriguing way in which to share their research with others, but also one that helped Kalshoven explore the theoretical possibilities of her work.

Lulof addresses the need in RRR research to not only think critically about why we document, but also about the technological forms in which we do this, when there is so much on offer in the digital realm for cataloguing, creating databases and amalgamating materials. How can we leave room

for doubt, annotation and change over time? Within the digital world of 3D modelling, scientific value has been doubted and fear of deception remains persistent, as structural uncertainty is difficult to visualise in digital models.[50] In practice, models generally give one version of the past instead of several interpretations; in this perception, digital models offer nothing more than the artist's watercolour-impressions of the past from the nineteenth century. The fear to deceive may have caused the focus on developing a common ground for 'good practices' within the field.[51] The focus on ways to visualise uncertainty characterises this trend.

In particular, the recent development of powerful visualisation platforms such as the three-dimensional Geographic Information System (3DGIS), and the introduction of digital acquisition tools provide opportunities to fully visualise and study in three dimensions (3D) the spatial and temporal relationships between the fragmented pieces of information detected in archaeological excavations. Very recently, these techniques have been connected to Unmanned Aircraft Systems (UAS, drones) and Lidar (Light detection and ranging) data, with the use of photogrammetry, to reconstruct archaeological sites, ancient built structures and city complexes in 3D and 4D; the fourth dimension being generally accepted as the 'element of transformation in time'.[52]

Together, the chapters in this book push for a more reflective approach to and use of RRR methodologies. Interdisciplinary reflection, as we engage in in this book, does not aim at developing a universal RRR method, one design that fits all disciplines. Instead, the gains of the interdisciplinary cross-fertilisation practiced in this book are first and foremost disciplinary, that is, specific and tailored for each discipline. By comparing methods across disciplines, the disciplines find inspiration and critical distance to reflect upon, and then further develop their own RRR practices. Through this interdisciplinary comparison of RRR methods, practitioners have access to pools of knowledge and experience in other disciplines that may help them deal with issues they likewise encounter; comparisons with RRR practices in other fields also offer the opportunity of making RRR

50 Reilly, 'Towards a Virtual Archaeology', discusses the 'pretty picture' trap as well as suggests how to visualise uncertainty; see Barceló et al., *Virtual Reality*, for more on this subject.

51 Frischer, *Beyond Illustration*. This period of doubt lasted from 1997 to 2008. Thinking about best practices, however, took away most concerns.

52 See Dell'Unto, 'The Use of 3D Models', pp. 51-58, Dell'Unto, 'Using 3D GIS', pp. 305-323 and Waagen, 'New Technology', pp. 11-20, for the most recent discussions on the use of GIS, 3D modelling and photogrammetry in studying excavations and ancient architecture.

practitioners aware of sometimes silent assumptions about RRR design in their respective disciplines so as to make room for more explicit reflection.

Which new insights has interdisciplinary cross-fertilisation generated, and how is this reflected in the chapters of this book? We have already mentioned four themes, but here finally, we want to highlight two issues as a starting point for future RRR research. First, this book has brought together process and product-oriented RRR practitioners. As we have seen, disciplines have acquired preferences for these two orientations, which is reflected in the typical 're'-terms which they have adopted. Interdisciplinary cross-fertilisation in this book has led to the insight that acting subjects and produced objects are always present in RRR research across disciplines and regardless of the process or product orientation, yet in variant constellations. The anthropologist Kalshoven, struck by the intense focus on materials in other disciplines, was attentive to materials in her work on replication in taxidermic practices, and has adopted the term 'reworking', introduced by historian of science Sibum, where anthropology more typically opts for 're-enactment'. Conversely, the conservator Carlyle, a strong advocate of intellectual rigour regarding material choices and whose home discipline typically uses the term 'reconstruction', adopts in addition the term 're-enactment' in her chapter to channel attention to skill and performance. Hopefully, this book contributes to making explicit the variant constellations of human agents and produced objects providing fruitful avenues for RRR research design.

Secondly, interdisciplinary cross-fertilisation also highlights creativity as a central aspect of RRR research. Research, perhaps foremost in the disciplines of anthropology and music, which are less historically inclined, complicates the temporalities of RRR and the distinction between original and replica or copy. While the aspirational qualities of historical accuracy are already widely recognised, it seems appropriate for this book to take the next step and to move away from the assumption that re-doing implies a lack of creativity. Indeed, only through interdisciplinary cross-fertilisation have the historical disciplines in this book become less blind to creativity. This recognition will allow RRR researchers to compare past and current creative practices rather than opposing the research agendas of historians and less historically inclined disciplines. There are many more gaps and threads this book leaves dangling and which will need further exploration in the future. We hope that this book inspires methodological innovations in creating performative approaches that question how to explore productively the tensions between past and present, and consider how the materiality and sociality of repetition in its many variations informs particular ways of making and knowing.

Bibliography

Agnew, Vanessa, 'What is Re-enactment?', *Criticism*, 46:3 (2004), pp. 327-339.

Applegate, Celia, *Bach in Berlin. Nation and Culture in Mendelssohn's Revival of the St. Matthew Passion* (Ithaca and London: Cornell UP, 2005).

Auhagen, Wolfgang, Wolfgang Hirschmann and Tomi Mäkelä (eds.), *Musikwissenschaft 1900-1930. Zur Institutionalisierung und Legitimierung einer jungen akademischen Disziplin* (Hildesheim: Olms, 2014).

Barceló, Juan A., and others (eds.), *Virtual Reality in Archaeology* (Oxford: Archaeopress, 2000).

Brajer, Isabelle, *Conservation in the Nineteenth Century* (London: Archetype, 2013).

Brinkman, Pim, *Het geheim van Van Eyck. Aantekeningen bij de uitvinding van het olieverven* (Zwolle: Waanders, 1993).

Campbell, Lorne, 'The Conservation of Netherlandish Paintings in the Fifteenth and Sixteenth Centuries', *Studies in the History of Painting Restoration*, ed. by Christine Sitwell and Sarah Staniforth (London: Archetype, 1998), pp. 15-26.

Coles, John M., *Experimental Archaeology* (London: Academic Press, 1979).

Conti, Alessandro, *History of the Restoration and Conservation of Works of Art* (Amsterdam: Butterworth-Heinemann, 2007).

Davis, Whitney, 'Art History, Re-Enactment, and the Idiographic Stance', in *Michael Baxandall, Vision and the Work of Words*, ed. by Peter Mack and Robert Williams (Farnham/Burlington: Ashgate, 2015), pp. 69-89.

Dell'Unto, Nicolò, 'The Use of 3D Models for Intra-site Investigation in Archaeology', in *3D Recording and Modelling in Archaeology and Cultural Heritage*, ed. by Fabio Remondino and Stefano Campana (Oxford: Archaeopress, 2014), pp. 151-158.

Dell'Unto, Nicolò, 'Using 3D GIS Platforms to Analyse and Interpret the Past', in *Digital Methods and Remote Sensing in Archaeology. Archaeology in the Age of Sensing*, ed. by Maurizio Forte and Stefano Campana (New York: Springer Publishing, 2016), pp. 305-323.

Eastlake, Charles Locke, *Materials for a History of Oil Painting* (London: Longman, Brown, Green and Longmans, 1847), 2 Vols. [Reprint: *Methods and Materials of Painting of the Great Schools and Masters*, 2 vols. (New York: Dover, 1960)].

Eigeldinger, Jean-Jacques, *Wanda Landowska et la renaissance de la musique ancienne* (Arles: Actes Sud, 2011).

Elste, Martin, *Meilensteine der Bach-Interpretation 1750-2000. Eine Werkgeschichte im Wandel* (Stuttgart: Bärenreiter, 2000).

Eybl, Martin, 'Guido Adler, die Denkmäler der Tonkunst in Österreich und die Anfänge der Musikwissenschaft an der Universität Wien: Konzeptze und Perspectiven', in *Musikwissenschaft 1900-1930: zur Institutionalisierung und Legitimierung einer jungen akademischen Disziplin*, ed. by Wolfgang Auhagen,

Wolfgang Hirschmann and Tomi Mäkelä (Hildesheim: Georg Olms Verlag, 2017), pp.250-261.

Fors, Hjalmar, Lawrence M. Principe, and H. Otto Sibum, 'From the Library to the Laboratory and Back Again: Experiment as a Tool for Historians of Science', *Ambix*, 63 (2016), pp. 85-97.

Frischer, Bernard, and Anastasia Dakouri-Hild, *Beyond Illustration, 2D and 4D Digital Technologies as Tools for Discovery in Archaeology* (Oxford: BAR International Series 1805, 2008).

Hermon, Sorin, 'Scientific Method*, chaîne opératoire* and Visualization: 3D Modelling as a Research Tool in Archaeology', in *Paradata and Transparency in Virtual Heritage*, ed. by Anna Bentkowska-Kafel and Hugh Denard (Farnham: Ashgate, 2012), pp. 13-22.

Holten, Lars, 'Engaging Experiments: From Silent Cultural Heritage to Active Social Memory', in *Experiments Past: Histories of Experimental Archaeology*, ed. by Jodi Reeves Flores and Roeland Paardekooper (Leiden: Sidestone Press, 2014), pp. 269-283.

Johnson, Katherine, 'Rethinking (Re)doing: Historical Re-enactment and/as Historiography', *Rethinking History*, 19 (2015), pp. 193-206.

Kalshoven, Petra Tjitske, *Crafting the Indian: Knowledge, Desire, and Play in Indianist Reenactment* (New York: Berghahn Books, 2012).

Lanjouw, Tijm, 'Discussing the Obvious or Defending the Contested: Why Are we Still Discussing the 'Scientific Value' of 3D Applications in Archaeology?', in *The Three Dimensions of Archaeology*, *Proceedings of the XVII UISPP World Congress, 1–7 September 2014, Burgos, Spain*, ed. by Hans Kamermans et al. (Oxford: Archaeopress, 2015), pp. 1-13.

Lulof, Patricia, and others, 'The Art of Reconstruction. Documenting the Process of 4D Modeling, Some Preliminary Results', in *Proceedings of the 2013 Digital Heritage International Congress* (*DigitalHeritage*), ed. by Alonzo C. Addison et al. (Marseille: IEEE Xplore, 2013), Vol. 2, pp. 333-337.

MacLachlan, James, 'Galileo's Experiments with Pendulums: Real and Imaginary', *Annals of Science*, 33 (1976), pp. 173-185.

Mann, Anna M., and others, 'Mixing Methods, Tasting Fingers: Notes on an Ethnographic Experiment', *HAU: Journal of Ethnographic Theory*, 1 (2011), pp. 221-243.

Merrifield, Mary P., *Medieval and Renaissance Treatises on the Arts of Painting. Original Texts with English Translations*, 2 Vols. (London: Murray, 1849) [Reprint 1967, 2 volumes reprinted as 1, Mineola, New York: Dover, 1999].

Moser, Stephanie, 'Archaeological Visualisation: Early Artefact Illustration and the Birth of the Archaeological Image', in *Archaeological Theory Today* (revised edition), ed. by Ian Hodder (Cambridge: Polity, 2012), pp. 292–322.

Mugglestone, Erica, 'Guido Adler's "The Scope, Method, and Aim of Musicology" (1885): An English Translation with an Historico-Analytical Commentary', *Yearbook for Traditional Music*, 13 (1981), pp. 1-21.

Nadolny, Jilleen, 'A History of Early Scientific Examination and Analysis of Painting Materials, ca. 1780 to the Mid-Twentieth Century', in *The Conservation of Easel Paintings*, ed. by Joyce Hill Stoner and Rebecca Rushfield (London: Routledge, 2012), pp. 336-340.

Nadolny, Jilleen, Mark Clarke, Erma Hermens, Ann Massing and Leslie Carlyle, 'Art Technological Source Research: Documentary Sources on European Painting to the Twentieth Century, with Appendices I-VII', in *The Conservation of Easel Paintings*, ed. by Joyce Hill Stoner and Rebecca Rushfield (London: Routledge, 2012), pp. 3-32.

Opgenhaffen, Loes and Maarten H. Sepers '3D Modelling: Crossing Traditional Boundaries Between Different Research Areas', in *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences,* Vol. XL-5/W4 (2015), pp. 411-414.

Outram, Allen K., 'Introduction to Experimental Archaeology', *World Archaeology*, 40 (2008), pp. 1-7.

Piccoli, Chiara, *Visualizing Citiscapes of Classical Antiquity: From Early Modern Reconstruction Drawings to Digital 3D Models* (Oxford: Archaeopress, 2018), pp. 6-49.

Pink, Sarah, and Kerstin Leder Mackley, 'Re-enactment Methodologies for Everyday Life Research: Art Therapy Insights for Video Ethnography', *Visual Studies*, 29 (2014), pp. 146-154:

Posluschny, Alex, and others (eds), *Layers of Perception*, Proceedings of the 35th International Conference on Computer Applications and Quantitative Methods in Archaeology, CAA (Bonn: Rudolf Habelt, 2008).

Principe, Lawrence M., 'Apparatus and Reproducibility in Alchemy', in *Instruments and Experimentation in the History of* Chemistry, ed. by L. Holmes and T. H. Levere (Cambridge, MA: The MIT Press, 2000), pp. 55-74.

Ratto, Matt, 'CSE as Epistemic Technologies: Computer Modelling and Disciplinary Difference in the Humanities', in *Handbook of Research on Computational Science and Engineering: Theory and Practice*, ed. by Joanna Leng and Wes Sharrock (Hershey: IGI Global, 2012), pp. 567-587.

RE-. An Errant Glossary, ed. by Christoph F.E. Holzhey and Arnd Wedemeyer (Berlin: ICI Berlin Press, 2019).

Reilly, Paul, 'Towards a Virtual Archaeology', in *Computer Applications and Quantitative Methods in Archaeology* (CAA 90), ed. by Sebastian Rahtz and Kris Lockyear (Oxford: Tempus Reparatum, 1991), pp. 132-139.

Routledge Handbook of Interdisciplinary Research Methods, ed. by Celia Lury et al. (London: Routledge, 2018).

Ruth-Sommer, Hermann, *Alte Musikinstrumente. Ein Leitfaden für Sammler* (Berlin: Richard Carl Schmidt & Co, 1916).

Ryan, Nick, 'Documenting and Validating Virtual Archaeology', *Giornale di Archeologia e Calcolatori*, 12 (2001), pp. 254-273.

Schäuble, Michaela., 'Living History? Reenacting the Past and Promoting "Tradition" in the Dalmatian Hinterland', *Nationalities Papers*, 47 (2017), pp. 198-216.

Settle, Thomas, 'An Experiment in the History of Science', *Science*, 133 (1961), pp. 19-23.

Sibum, H. Otto, 'Experimental History of Science', in *Museums of Modern Science*, ed. by Svante Lindqvist (Canton, MA: Science History Publications, 2000), pp. 77-86.

Sibum, H. Otto, 'Reworking the Mechanical Value of Heat: Instruments of Precision and Gestures of Accuracy in Early Victorian England', *Studies in the History and Philosophy of Science*, 26 (1995), pp. 73-106.

Smith, Pamela H., and The Making and Knowing Project, 'Historians in the Laboratory: Reconstruction of Renaissance Art and Technology in the Making and Knowing Project', *Art History*, 39 (2016), pp. 210-233.

Staubermann, Klaus, *Reconstructions Recreating Science and Technology of the Past* (Edinburgh: NMSE – Publishing Ltd, 2011)

Stiebing, William H., *Uncovering the Past: A History of Archaeology* (Oxford: Oxford University Press, 1993).

Suchman, Lucy, 'Configuring the Other: Sensing War through Immersive Simulation', *Catalyst: Feminism, Theory, Technoscience*, 2 (2016), pp. 1-36.

Taruskin, Richard, *Text and Act. Essays on Music and Performance* (Oxford: Oxford University Press, 1995).

Thomas, Anabel, 'Restoration or Renovation: Remuneration and Expectation in Renaissance 'acconciatura'', in *Studies in the History of Painting Restoration*, ed. by Christine Sitwell and Sarah Staniforth (London: Archetype, 1998), pp. 1-14.

Thompson, Daniel V., *Materials and Techniques of Medieval Painting* (London, 1938) [unabridged and unaltered republication London: Dover, 1956].

Waagen, Jitte, 'New Technology and Archaeological Practice. Improving the Primary Archaeological Recording Process in Excavation by Means of UAS Photogrammetry', *Journal of Archaeological Science*, 10 (2018), pp. 11-20.

Wenzel Geissler, Paul, and Ann Kelly, 'Kidewu's Return: Reenacting Mid 20th-century Science', in *Traces of the Future: An Archaeology of Medical Science in Africa,* ed. by Paul Wenzel Geissler, Guillaume Lachenal, John Manton and Noemi Tousignant (Bristol, UK: Intellect, The University of Chicago Press, 2016), pp. 150-153.

Wrapson, Lucy, Jenny Rose, Rose Miller and Spike Bucklow, *In Artists' Footsteps: The Reconstruction of Pigments and Paintings. Studies in Honour of Renate Woudhuysen-Keller* (London: Archetype, 2012).

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