

HIST G8906: Craft and Science: Making Objects in the Early Modern World
Fall 2015
Monday 10:10am-2:00pm
Chandler 260

Co-Instructors:

Prof. Pamela Smith

Office: Fayerweather 605

Dr. Donna Bilak

Office: Heyman Center B206

Dr. Jenny Boulboulé

Office: Heyman Center B206

Dr. Joel Klein

Office: Heyman Center B206

M&K Project Manager:

Naomi Rosenkranz

Lab Assistant:

Nilam Patel

This course will study the materials, techniques, settings, and meanings of skilled craft and artistic practices in the early modern period (1350-1750) in order to reflect upon a series of issues, including craft knowledge and artisanal epistemology; the intersections between craft and science; and questions of historical methodology and evidence in the reconstruction of historical experience. The course will be run as a “Laboratory Seminar” with discussions of primary and secondary materials, as well as hands-on laboratory work. This course is one component of the Making and Knowing Project of the [Center for Science and Society](#) and more information on the Project can be found [here](#). Thus, in its first years, this course contributes to the collective production of a transcription, English translation, and critical edition of a late sixteenth-century manuscript in French, Ms. Fr. 640.

Making and Knowing Online: You can follow the project on Twitter @makingknowing and tweet any photos from the laboratory (which we can then re-tweet).

Students are encouraged to take this course both semesters (or more), but will receive full credit only once. Different laboratory work and readings will be carried out each semester.

A course prerequisite is to complete laboratory safety training. No registration is required for safety training; you may simply show up and attend. Your attendance will be recorded and stored electronically in the RASCAL system, where you will be able to print a training certificate as proof of training.

Course Organization

This course will be conducted by discussion of readings and hands-on work in the laboratory. Readings will include primary sources and literature drawn from material culture studies, anthropology, history of science and technology, and art history, as well as an introduction to historical reconstruction and to BnF Ms. Fr. 640. Students will contribute to the research on Ms. Fr. 640 by finding and comparing contemporaneous primary sources and discussing their value for a better understanding of the recipes and methods described in the Ms. Fr. 640. At the same time, a series of introductory lab sessions on making and materials will be conducted. The course will then turn to the reconstruction of the

techniques in Ms. Fr. 640. Using a transcription and English translation, the laboratory portion of the course will focus each year on a single set of related techniques described in the manuscript. In 2014-15, the focus was on mold-making and metalworking, including sand and plaster casting. In 2015-16, the focus is on color making, including dyeing and painting pigments, coloring woods and metals, varnishes, and artificial gem making.

Work in the laboratory each semester will include a two-week residency by an expert maker, who will participate in the seminar and lead demonstrations and experiments in the lab. This semester's expert practitioner is Marjolijn Bol (U. Amsterdam & MPIWG). She will be in residence **October 5-16. Participants are expected to schedule extra time for lab work during this period.**

On May 25-28, 2016, an international meeting of experts in colors and color-making (Working Group Meeting) will be held at Columbia in order to review the progress made on the project. Students from both semesters will be expected to present at this meeting.

On June 6-24, 2016, a Renaissance French Paleography and data visualization seminar will be offered at Columbia in order to finalize the digital version of the manuscript transcription and translation for publication, and to explore the possibilities for data visualization.

Assignments and Evaluation

Discussion

All students are expected to come prepared for discussion. **Discussion participation accounts for about 10% of the total grade.**

Hands-on Assignments

Students will keep field notes (in written, visual, or podcast form) on their experiences and experiments in the Class Wiki, documenting their experiments in reconstruction, as well as their methodological reflections on the uses of hands-on work and reconstruction as historical sources. They will upload their photos to the [Flickr photo repository](#).

Each group will be assigned laboratory tasks:

Data organization: ensures tagging of photos and wiki-entries by all groups. Sorting of photos into albums.

Lab organization: ensures that all lab members have labeled their materials and put away all tools.

Safety monitoring: ensures that students have read the Materials Data Safety Sheets and are working safely (lab coat, safety glasses, gloves, and dust mask, when necessary).

Open lab times will be announced throughout the semester, but will generally be held Monday afternoons, Wednesdays, and Fridays. **The laboratory component of the course will be worth 30% of the grade.**

Written assignments

Students will contribute to the decipherment of the text of Ms. Fr. 640, and they will contribute annotations to the translation and critical edition of the manuscript. They will

assist in maintaining and contributing to the course Wiki and Field Notes, and they will make every effort to take part in the final Working Group Meeting to be held in May.

Working in groups, students will contribute three short annotation essays (750-3000 words) to the critical edition, similar to a catalog entry for an exhibition. These essays will make use of a whole range of visual and textual sources, and will integrate the students' laboratory experiences into a written or visual presentation that makes an argument about what research (both textual and material) into the recipe revealed about process, materials, sixteenth-century culture and society, or the identity of the author. One of the most important components of this assignment is the research that students will undertake on the relationship of recipes in Ms. Fr. 640 to other earlier and contemporaneous recipe collections. **The annotation assignment comprises 60% of the grade.**

Student research essays resulting from this semester are contained in [*Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640.*](#)

- [Color of Gold without Gold on Silver](#)
- [Colors for Green Leaves and Painting on Metal](#)
- [Damasked Cloth](#)
- [Gemstones and Imitation](#)
- [Jasper Imitation on Horn](#)
- [Imitation Emeralds](#)
- [Imitation Rubies and Failure in Ms. Fr. 640](#)
- [Paintbrushes in Ms. Fr. 640](#)
- [Painting in Oil on Taffeta I](#)
- [Painting in Oil on Taffeta Without the Oil Running](#)
- [Reverse Painting on Glass](#)

Reading

The following **required** course books are available at Book Culture and on reserve at Avery Library.

The following provide an introduction to color making:

- David Bomford, A. Roy, *A Closer Look: Colour*, London, 2009
- Jo Kirby, *A Closer Look: Techniques of Painting*, London, 2011
- Daniel Varney Thompson, *The Materials and Techniques of Medieval Painting* (Courier Dover Publications, 1956)

The following provide an introduction to the history of the relationship between craft and science:

- Pamela O. Long, *Artisan Practitioners and the Rise of the New Sciences, 1400-1600* (Oregon State UP, 2011)
- Pamela H. Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago and London: The University of Chicago Press, 2005)

The following will be useful as reference texts throughout the course:

- Theophilus, *The Various Arts. De Diversis Artibus*, ed. and trans. C. R. Dodwell (Oxford: Clarendon Press, 1986)

- Benvenuto Cellini, *Two Treatises*, trans. C. R. Ashbee (repr. 2006)
- Merrifield, Mary P., *Medieval and Renaissance Treatises on the Arts of Painting: Original Texts with English Translations* (Courier Dover Publications, 2012)
- Cennino Cennini, *The Craftsman's Handbook, 'Il Libro dell'Arte'*, trans. by Daniel Thompson (New York: Dover, 1960)

Recommended:

- Tim Ingold, *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill* (London and New York: Routledge, 2000)
- Robert Tarule, *The Artisan of Ipswich: Craftsmanship and Community in Colonial New England* (Johns Hopkins University Press, 2004)
- Pamela H. Smith, Amy R. W. Meyers, and Harold J. Cook (eds.), *Ways of Making and Knowing* (University of Michigan Press, 2014)
- Christy Anderson, Anne Dunlop, and Pamela H. Smith, *The Matter of Art: Materials, Practices, and Cultural Logics, c. 1250-1800*.

Class Schedule

Below you will find what to prepare for class in **the week before** the class meeting, and what to expect on the day of class. Please be sure to ask in advance if anything is not clear!

Week 1: ART AND SCIENCE

In preparation for September 14:

To watch:

- Watch the introduction to the manuscript and the project [here](#) (ca 1 hour)
- Watch "Lions, Dragons, and other Beasts" (ca. 1 hour) [here](#)

To read:

- Bomford, David, A. Roy, *A Closer Look: Colour*, London, 2009
- Kirby, Jo, *A Closer Look: Techniques of Painting*, London, 2011
- Thompson, Daniel Varney, *The Materials and Techniques of Medieval Painting* (Courier Dover Publications, 1956)

To do:

- Explore the Project's Google Drive collaborative space
- Browse the manuscript [here](#)

What to expect in class on Monday, September 14:

- Bring your laptop or tablet to class.
- 10:10-11:00 Introductions all around, and introduction to the project (brief lecture by P. Smith)
- The course in brief, expectations, skills, and your contribution to the project. Come with questions!
- Navigating the manuscript
- Discussion of Home Culinary Reconstruction Assignment (division into groups).
- **Due Monday, September 21 in class**
- 11am-12:00 **Safety training** (Kathy Heinemann)
- 12-12:15 **break**
- 12:15-2:00 making verdigris (find verdigris recipes in Merrifield, and begin work)
 - make red for coloring wood (home experiment), fol. 76r

Week 2: HOME CULINARY RECONSTRUCTION AND CONSUMPTION

In preparation for Monday, September 21:

- You will want to start on the Historical Culinary Recipe Reconstruction (HCR) right away, by reading the assignment carefully, exploring and using the websites listed on the HCR assignment sheet to search for comparable recipes in contemporaneous sources, and doing the following reading **BEFORE** starting your reconstruction:

Required Reading and Watching:

- Ken Albala, "Cooking as Research Methodology: Experiments in Renaissance Cuisine," *Renaissance Food from Rabelais to Shakespeare: Culinary Readings and Culinary Histories*, ed. Joan Fitzpatrick (Aldershot, UK: Ashgate, 2010), pp. 73–88.
 - ◆ See also Ken Albala's blog on: <http://kenalbala.blogspot.nl/>
- Ad Stijnman, "Style and technique are inseparable: art technological sources and reconstructions," *Art of the Past. Sources and Reconstructions. The proceedings of the First Symposium of the Art Technological Source Research Study Group*, ed. by Mark Clarke, Joyce H. Townsend, and Ad Stijnman (Amsterdam: Archetype, 2005): 1-8.
- Francisco Alonso-Almeida, "Genre conventions in English recipes, 1600-1800," *Reading and Writing Recipe Books, 1550-1800*, Michelle DiMeo and Sara Pennell (Manchester: Manchester University Press, 2013), pp. 68-90.
- Syrup of Violets and Science: <https://www.youtube.com/watch?v=pdEbMBe0aa8>
- Maartje Stols-Witlox, "Sizing layers for oil paintings...," *Proceedings of the Second ATSR Symposium* (2008), pp. 148-163.

September 21, in class:

- We will meet in The Studio at Butler (Butler 208b), where the groups will present on their HCR (prepare presentations and practice them; 10 mins. per group).
- Bring the material results of your HCR. We will consume them, if safe!
- 10:10-11:30 Student presentations, and discussion of required readings.
- 11:30-12:15 Introduction to field and lab notes with Prof. Brian Boyd (Anthropology) and Dr. Joseph Ulichny (Chemistry)
- 12:15-1:15 Wiki practice and profiles with Jonah Bossewitch (CCNMTL)
- 1:15-2:00 Meredith Levin, Subject Specialist for European History and History of Science.

WEEK 3: THE MEANINGS OF MATERIALS: COLORS AND GEMS

In preparation for September 28:

Reading:

- Marcia Hall, *Color and Meaning: Practice and Theory in Renaissance Painting*, pp. 1-18, 47-57, 69-74, 92-116, 222-230.
- Leonhard, Karin: "Painted Poison. Venomous Beasts, Herbs, Gems, and Baroque Colour Theory." *Nederlands Kunsthistorisch Jaarboek* (NKJ) (2011)
- From Christy Anderson, Anne Dunlop, and Pamela H. Smith, *The Matter of Art: Materials, Practices, and Cultural Logics, c. 1250-1800*, **the essays by Anne Dunlop, Spike Bucklow, and Brigitte Buettner:**
 - ◆ Anne Dunlop, 'On the origins of European painting materials, real and imagined'
 - ◆ Spike Bucklow, 'Lead white's mysteries'
 - ◆ Brigitte Buettner, 'Precious stones, material beings: performative materiality in fifteenth-century northern art'

- Ann-Sophie Lehmann, "Wedging, Throwing, Dipping and Dragging – How Motions, Tools and Materials Make Art," *Folded Stones*, eds. Barbara Baert and Trees de Mits (Institute for Practice-based Research in the Arts: Ghent 2009), pp. 41-60.

Optional:

- Michael W. Cole, "Cellini's Blood," *The Art Bulletin* 81.2 (1999): 215–35.
- Pamela H. Smith, "Knowledge in Motion: Following Itineraries of Matter in the Early Modern World," in Daniel Rogers, Bhavani Raman, Helmut Reimitz, eds., *Cultures in Motion* (Princeton: Princeton University Press, 2014), 109-33.
- Karin Leonhard, "Pictura's fertile field: Otto Marseus van Schrieck and the Genre of Sottobosco Painting." *Simiolus. Netherlands Quarterly for the History of Art* 34 (2 2009/2010)

Browse on gems:

- Bernard Palissy, *Recette veritable* (recent French edition) and *The Admirable Discourses* (Engl. edition)
- Marbode, *Liber de lapidibus* Call Number: NK7309.3 .F67 2013g English version
- Albertus Magnus, *De Mineralibus*, (English version)
- Forsyth, Hazel, *The Cheapside Hoard: London's lost jewels* (Philip Wilson Publishers, c2013)

September 28, in class:

- 10:10-11:00 **Wiki** practice, discussion of **annotations**, answering any **questions**.
- 11:00 Fire extinguisher practice with Harry Oster - 11 AM in front of Chandler
- 12:15-2:00 Discussion of readings
- Report on (optional) home experiments (verdigris)

Week 4 & 5: EXPERT MAKER VISIT: MATERIAL MIMESIS (October 5-16)

Prof. Marjolijn Bol will be leading the course in reconstructions. Be prepared to spend more time in the lab; you will have individual group time with her)

Also, at the end of her first week (Oct 9-10), we have organized a RECONSTRUCTION WORKSHOP at the Chemical Heritage Foundation in Philadelphia. You are cordially encouraged to attend.

Preparation for October 5: Colors and Materials: Optical properties

Required Reading and Watching:

- Go to see [this exhibition](#) at the Met
- Watch as many as possible of the videos collected on the Wiki on pigment- and color-making, as well as on the TAH website, and other online pigment resources.
- Marjolijn Bol, "Coloring Topaz, Crystal and Moonstone: Gems and the Imitation of Art and Nature, 300-1500," in *Fakes!?: Hoaxes, Counterfeits and Deception in Early Modern Science*, ed. Marco Beretta and Maria Conforti (Sagamore Beach: Science History Publications, 2014)
- Marjolijn Bol, "Deceiving Stuff: Histories, Functions, Techniques and Effects of Material Mimesis," *Innovational Research Incentives Scheme, grant application form 2014, Netherlandish Organisation for Scientific Research (NWO)*.
- Joanna Whalley, "Faded Glory: Gem Simulants and Enhancements,"
- Search and identify color-related recipes in Ms. Fr. 640 (Bring information to class)

October 5, in class:

10:10 Introductions

Marjolijn Bol lecture

Experiments in optical properties of binders and pigments

Introduction to Annotations

October 9-10: Reconstruction Conference, CHF, Philadelphia

WEEK 5: MAKING IMITATION GEMS

Preparation for October 12:

Required Reading:

- Continue searching for interesting gem and color recipes in sources.

Browse on gems:

- Bernard Palissy, *Recette veritable* (recent French edition) and *The Admirable Discourses* (Engl. edition)
- Marbode, *Liber de lapidibus* Call Number: NK7309.3 .F67 2013g English version
- Albertus Magnus, *De Mineralibus*, (English version)
- Forsyth, Hazel, *The Cheapside Hoard: London's lost jewels* (Philip Wilson Publishers, c2013)

At the end of Marjolijn's visit, we will discuss your proposed annotations, so please be ready with annotation ideas. Begin thinking about the historical question your annotation will answer, begin compiling a materials list for experiments, and start developing a protocol for experimentation on your recipe(s).

October 12, in class:

- Further gem and color reconstruction.
- Discussion of students' proposed annotations

Tuesday, Oct. 13: 1-2:30 visit and demonstration at the Kremer Pigments Store.

Meet on Thursday, October 15: 1-3pm wrap-up meeting with Marjolijn Bol.

Week 6: RED LAKES RECONSTRUCTION WORKSHOP

This workshop will take place simultaneously at Columbia University and at the University of Glasgow with students from the Masters *Technical Art History: Making and Meaning*. We will connect via Skype to discuss questions and results.

In preparation for October 19:

Required Reading and Watching on Reconstruction:

- Adelheid Voskuhl, "Recreating Herschel's Actinometry: An Essay in the Historiography of Experimental Practice," *British Journal for the History of Science*, 30.3 (1997): 337-355.
- Hasok Chang, 'How Historical Experiments Can Improve Scientific Knowledge and Science Education: The Cases of Boiling Water and Electrochemistry', *Science and Education* 20 (2011), 317-341.
- For research into recipes in order to reconstruct them, followed up by scientific analyses see: J. Dik, E. Hermens, R. Peschar, H. Schenk, 'Early Production Recipes for Lead Antimonate Yellow in Italian Art', *Archaeometry*, Volume 47, Issue 3, pages 593-607, August 2005
- Reconstruction of alchemical experiments ([Chymistry of Isaac Newton](#))

Further essential reading:

- Jo Kirby et al, *Natural Colorants for Dyeing and Lake Pigments: Practical Recipes and their Historical Sources* (Archetype Publications, London, 2014). This key book discusses the various dyes stuff, their preparation as dyes and pigments. The text contains many recipes as well as reconstructions up till the 19th century. Focus on the 16th-17th century sections for the workshop. Our reconstruction recipes are in this book.
- Erma Hermens and Arie Wallert, 'The Pekstok Papers: Lake Pigments, Prisons and Paint Mills', in E. Hermens et al. eds, *Looking through Paintings*, De Prom/Archetype, Baarn/London 1998, pp. 269-294.
- Jo Kirby and Raymond White, 'The Identification of Red Lake Pigment Dyestuffs and a Discussion of their Use', *National Gallery Technical Bulletin*, Vol. 17 (1996), pp. 56-80.
- Jo Kirby, Marika Spring and Catherine Higgitt, 'The Technology of Red Lake Pigment Manufacture: Study of the Dyestuff Substrate', *National Gallery Technical Bulletin*, Vol. 26 (2005), pp. 71-87.
- See also the powerpoint made by Jo Kirby and colleagues showing the way they worked with recipes and connecting them to scientific analyses.

Search for red lake recipes in BnF Ms. Fr. 640 and in our source books:

- Cennino Cennini, *Il libro dell'Arte (The Craftsman's Handbook)*, trans. Daniel V. Thompson, Jr. (New York: Dover, 1960)
- Theophilus, *The Various Arts: De Diversis Artibus*, ed. and trans. C. R. Dodwell (Oxford: Clarendon Press, 1986)
- Merrifield, Mary P., *Medieval and Renaissance Treatises on the Arts of Painting: Original Texts with English Translations* (Courier Dover Publications, 2012)
- Benvenuto Cellini, *Two Treatises*, trans. C. R. Ashbee (repr. 2006)

Additional sources:

- Alessio Piemontese, *Book of Secrets* (1555); various English versions on EEBO; French versions on Gallica; Italian versions—you find them!—different groups use different editions BEFORE 1600. (For English: Search for Ruscelli, Girolamo, *The secretes of the reuerende Maister Alexis of Piemount Containyng excellent remedies against diuers diseases, woundes, and other accidents, with the manner to make distillations, parfumes, confitures, diynges, colours, fusions and meltynges. ... Translated out of Frenche into Englishe, by Wylliam Warde* (1558)
- Hugh Platt, *The Jewell House of Art and Nature: Containing diuers rare and profitable Inventions, together with sundry new experimentes in the Art of Husbandry, Distillation, and Molding* (London, 1594)
- Arie Wallert, "Libro Secondo de Diversi Colori e Sise da Mettere a Oro: A Fifteenth-Century Technical Treatise on Manuscript Illumination," *Historical Painting Techniques, Materials, and Studio Practice* (Getty pre-print, 1995), in GD.
- The COLOUR ConTEXTdatabase Online
- Cologne database of recipes
- Also see Doris Oltrogge, "The Cologne database for painting materials and reconstructions," *Art of the Past. Sources and Reconstructions. The proceedings of the First Symposium of the Art Technological Source Research Study Group*, ed. by Mark Clarke, Joyce H. Townsend, and Ad Stijnman (Amsterdam: Archetype, 2005): 9-15.
- <http://travelingscriptorium.library.yale.edu/>

October 19, in class:

Introductions among class members, and Reconstruction Workshop: During the workshop, we will reconstruct two recipes to make two different red lake pigments.

1. Recipe for a red lake made from cochineal (17th Century)
2. Recipe for a red lake pigment from brazil wood (15th century)

(In Glasgow, a week before the workshop, the class will reconstruct a red lake recipe made from madder-dyed wool clippings. This is a rather more complex process which needs a lot of preparation (dyeing of wool!) and needs fume hoods etc. hence it will be a demonstration and not a class exercise. Glasgow will film the introductory lecture and the demonstration and make that available to the Columbia University students.)

Week 7: ANNOTATIONS

In preparation for October 26,

- **Solidify Annotation Plans**
- Identify the recipes that your group will annotation in BnF Ms. Fr. 640.
- Search relevant source materials for more information on color making recipes that relate to your annotation experiments. All students must upload to the Wiki by October 25 a full list of as many relevant recipes they have found in Ms. Fr. 640 and in other sources.

In class:

Discussion of annotations. Over the break, you should make sure that your materials lists are finalized and sourced, and that your protocol is written (please upload these to the Wiki also). Be completely ready to start implementing your experiments on November 9.

Week 8: UNIVERSITY HOLIDAY

Week 9: ANNOTATIONS

In preparation for November 9:

Reading:

- Pamela O. Long, *Artisan Practitioners and the Rise of the New Sciences, 1400-1600* (Oregon State UP, 2011), Intro-ch. 2 (pp.1-62)
- Pamela H. Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago and London: The University of Chicago Press, 2005), entire.

In class, November 9:

- Dr. Apoorva Jayaraman, Kalakshetra Foundation, Chennai, India, will present a brief account of intersections between craft and science
- discussion of readings
- intro to writing your annotation in Google docs, if necessary
- any questions on finalized annotation plans
- carry on with research and experiments

Week 10: EXPERIMENTING

November 16: Work on annotation experiments

Week 11: EMBODIED KNOWLEDGE

Preparation for November 23:

Watch, Ian Hankey, [Working with Venetian style glass](#)

Read:

- Raymond Tallis, *The Hand: A Philosophical Inquiry into Human Being*, (Edinburgh: Edinburgh University Press, 2003), Ch. 1.
- Erin O'Connor, "Embodied knowledge in glassblowing: the experience of meaning and the struggle towards proficiency," *Sociological Review* (2007): 126-141. Tim Ingold, *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill*, (London and New York: Routledge, 2000), Ch. 18-19 (pp. 339-361).
- Julian Thomas, "Phenomenology and Material Culture," in *Handbook of Material Culture*, ed. Christopher Tilley et al. (Sage 2006), 43-59.

In class, November 23:

- discussion of readings
- work on annotation experiments

Week 12: First draft of annotations due this week (Dec. 3)

November 30: Work on annotation experiments and writing.

December 3: Annotation drafts due by midnight. All class members read all annotations.

Week 13: Annotation Workshop

December 7: Come with suggestions for other students' annotations.

Week 14:

December 14: Further lab and writing work on annotations.

December 16: Annotation second drafts due today at midnight. All class members read all annotations.

Week 15:

Monday, December 21: Final Annotation workshop. Exit interviews.

****FINAL ANNOTATIONS DUE ON DECEMBER 23, at noon****

May 26-28 - Working Group Meeting, attendance required, if at all possible.

June 6-24 - Paleography and Data Visualization Workshop

Four questions to consider in working with objects and materials:

1. Materials: What material(s) make up your object? What are that material's properties? Where was it sourced? What determined its quality? How is the material described today (scientific analysis, material safety description (MSDS sheet))? How was the material described in written sources of the time (e.g., "unctuous," composed of water and earth, etc)? In addition to "workability," properties might also include the availability of materials in certain locales (by virtue of natural morphology or of trading patterns). How was knowledge of materials transmitted and disseminated (orally, by group working conditions, in writing, by templates)?

2. Technology: What tools, instruments and techniques were used for the transformation of your material in different places at different moments? How did that technology move and change over time? What were the consequences of these changes?

3. Performance: How did a specific conjunction of materials and technologies give rise to certain practices of making? In what ways did they constrain makers or require know-how? How did makers work against these limits (for example by manipulating the materials to vary their properties)? What were the circumstances for the display of skill: did makers change their practices when working in different places or when being watched by particular audiences? What were regarded as the signs of virtuosity, and how did these vary at different places at different moments? What was the role of the individual maker as opposed to the collaborative team? How does an object generate a "personality" or "sensitivity" for the person or workshop that produced it? How did new technologies change bodily experiences and gave rise to specific forms of practical expertise? How do embodied practices vary through time? Under which conditions might our bodily experience when reconstructing a pre-modern experiment be comparable to what practitioners have experienced in the past?

4. The system of the arts: What were the social structures that supported certain forms of production and consumption (e.g., associations such as guilds, workshops, manufactories)? How were practices of making limited by the law? Reshaped by ambition? What practices of making were interdependent? Which were siblings)? What was the relationship between making and status? How was the meaning of an object made manifest by its use, which could occur in rituals, through written treatises, or through daily use of the object?"

Two further issues to consider throughout:

Evidence: How do we know what a thing was made of and how it was made? What do texts tell us, what can we learn directly from objects or from present-day practices? How does one kind of evidence affect the way we understand another? What is the status as historical evidence of the emergent knowledge produced by reconstructions?

Historiography: How have historians treated these materials and their transformation? What kinds of narratives have historians constructed around and about materials and processes that give them meaning (whether bound up with professional and national narratives, with issues of identity or of rationality, or something else)? How have historians of science reflected on experimental reconstructions as a tool to recreate historical experience?