

HPSC0059 Science, Art and Philosophy



Course Syllabus

2023-24 session I Chiara Ambrosio | c.ambrosio@ucl.ac.uk

Course Information

This module explores the interactions between science and art from the mid-nineteenth century to the present. Its philosophical focus is the notion of "representation", conceived as a crucial common link between scientific and artistic visual practices. Integrating the history and philosophy of scientific and artistic representations, the course will address a broad range of issues. These will include questions on the nature and role of visual representations in scientific and artistic practice, what counts as "objective" and "accurate" representation, when and how images count as "evidence", and whether the relations between science and modernism contribute to overturn the common sense view that "art invents, science discovers".

Basic course information

Course website:	Not available
Moodle Web site:	Search HPSC0059
Assessment:	Progress Review (formative); Catalogue Entry (100%)
Timetable:	Lecture: Tuesday 9-11. Seminars run in two groups (Thursdays 9-10am and 10-11am). Please note that some seminars will run at the UCL Art Museum (details below and on moodle)
Prerequisites:	No prerequisites
Required texts:	See the reading list
Course tutor(s):	Prof Chiara Ambrosio
Contact:	c.ambrosio@ucl.ac.uk
Web:	
Office location:	22 Gordon Square, Room 1.2.
Office hour:	Fridays 11-1, room 1.2, 22 Gordon Square. Please email me for an appointment.

How the module works:

This course will be delivered entirely in person. This means you will be expected to attend all lectures and seminars. Lectures will take place on Tuesdays, 9-11. Seminars are scheduled on Thursdays, 9-10 or 10-11 (your allocated seminar slot should appear on your timetable; you will attend one seminar per week). Some of the seminars will take place at the UCL Art Museum, rather than in our allocated teaching room. These sessions are clearly signposted in the syllabus and in moodle.

Below is a weekly schedule for this term, followed by a week-by-week list of required and further readings. Please complete the readings and annotate them before attending the lecture. Then attend the lecture and match its contents with what you understood from the readings, revisit the readings after the lecture to see whether you missed anything or need to go more in depth on a particular aspect of the topic covered.

In the seminars we will work with images, objects and artifacts that connect to the readings, using them as case-studies. I will assume that you will be familiar with the readings when you will join the seminars, and we will use those sessions to refine our knowledge, understanding and application of the key concepts covered in the lectures and in the readings.

On some weeks, you will be invited to locate examples (scientific or artistic images, objects, instruments) that you think connect to the topic covered. On other weeks, you will be expected to complete a simple forum activity. *It is very important that you engage in all these activities*: they are especially planned to make you feel connected to the module and interact with each other. They will also help you build the skills you need in preparation for the final assessments.

The content and framing of this module:

This module explores the notion of “representation” as a crucial link between scientific and artistic visual practices. Drawing on a variety of interpretative tools from analytical and continental philosophical traditions, the course will address a range of philosophical questions arising from the parallel histories of representations in science and art. These will include issues concerning the nature and role of visual representations in scientific and artistic practice, what counts as “objective” and “accurate” representation, when and how images count as “evidence” in the sciences, and whether the relations between science and modernism contribute to overturn the common sense view that “art invents, science discovers”.

Schedule

Dates	Topic
Lecture 9 Jan	Lecture 1 – Introduction: Why ‘Representations’?
Seminars	Readings: Kern; the module syllabus

11 Jan	<p>This seminar will take place in our allocated teaching room (see UCL Timetable)</p> <hr/> <p>Tasks for this week (to be completed <u>before</u> you do the readings!):</p> <ol style="list-style-type: none"> 1. If you joined this module, it is probably because you have an interest in the relationship between science, art and philosophy. So, here is an ice-breaker: in this week’s forum, post an image, a photograph of an object/artefact/instrument that captures your reasons for joining this module. It can be an image/object from art, science, or both! And it can be from any historical period. <p>We will discuss your choices <u>in the seminars on Thursday</u>, and we will try to see whether any of them connect to this week’s readings.</p> <p>Start looking at the moodle syllabus, and particularly at the descriptions and assigned readings for each session. Which topic captivates your attention, and what would you like to work on for your final project? Start planning ahead from now – you will need to submit a formative progress report on your project at the beginning of March.</p>
<p>Lecture 16 Jan</p> <p>Seminar 18 Jan</p>	<p>Lecture 2 – Denotation, Convention, and the Riddle of Style</p> <p>Readings: Goodman <u>or</u> Gombrich</p> <p>This session will take place at the UCL Art Museum</p> <hr/> <p>Task for this week: Art Museum Seminars</p> <p>Before attending the seminars, watch the introduction to the UCL Art Museum, under ‘Lecture 2’ in moodle. We will use some artworks from the UCL Art Collections in the seminars, and will discuss Goodman and Gombrich in relation to those concrete case studies. Be prepared to answer a question you will hear over and over this term: ‘<u>What do you see?</u>’</p>
<p>Lecture 23 Jan</p> <p>Seminar 25 Jan</p>	<p>Lecture 3 – Representation, Classification, and the Order of Things</p> <p>Readings: Foucault</p> <p>This seminar will take place in our allocated teaching room (see UCL Timetable)</p> <hr/> <p>Tasks for this week</p> <ol style="list-style-type: none"> 1. <u>Before the readings and the lecture:</u> <p>Observe Velasquez’s Las Meniñas (on Moodle). Try to note down what you see. What do you think is happening in this painting? Make a list of the elements of the painting you think are worth noticing. Can you reconstruct the painting’s narrative? Is there a narrative (or more than one)? Keep your notes, and revisit them after having completed the readings and watched the lecture.</p> <ol style="list-style-type: none"> 2. <u>Post a Foucaultian image with commentary in this week’s forum (complete by Wednesday afternoon).</u> <p>It is easy to see how Foucault’s ideas can help us flesh out the contingency, historicity and persistence of power structures from representations that purport to be ‘neutral’. It is much harder to <i>explain</i> the work Foucault can help us do on and with images. This week I would like you to post an image that you think can be read through a Foucaultian concept or idea discussed in the lecture. In addition to this, I would like you to articulate in writing <i>how</i> Foucault might make</p>

	<p>us look at that image differently. Do it briefly on this week’s forum: just a couple of paragraphs (200 words) will do, and we will comment them in the seminars. Make sure you read each other’s Foucaultian interpretations, and if you can comment on <u>at least one</u> of your peers’ post.</p> <p>We will discuss your posts in the seminars on Thursday.</p>
Lecture 30 Jan	Lecture 4 – Before Objectivity: Truth-to-Nature
Seminar 1 Feb	<p>Readings: Daston and Galison</p> <p>This week’s seminar will take place at the UCL Art Museum.</p>
	<p>Your task for this week: Art Museum live seminars</p> <p>We will use some artworks from the UCL Art Collections in the seminars on Thursday, and will discuss Daston and Galison in relation to those concrete case studies. Be prepared to brainstorm on a selection of exciting images!</p>
Lecture 6 Feb	Lecture 5 – The Conundrum of Representation in Philosophy of Science
Seminars 8 Feb	<p>Readings: Frigg and Hunter or Suárez</p> <p>This seminar will take place in our allocated teaching room (see UCL Timetable)</p>
	<p>Your tasks for this week (complete by <u>Wednesday afternoon</u>):</p> <ol style="list-style-type: none"> 1. This week’s readings present several philosophical approaches to the question of representation. Some try to rescue a role for similarity, others try to do away with it. But what do you think is, precisely, the issue with similarity-based accounts of models and representations? And where do you stand in that debate? Formulate your own philosophical view on this issue, and we will discuss it in the seminar on Thursday. 2. Are you thinking about your project? We will spend some time in this week’s seminars discussing assessment criteria and what is expected from the progress review and catalogue entry. Please make sure you read the assessment instructions, on the syllabus and in moodle, and come prepared with questions.
Week of 12 Feb	<p>Reading Week – no lectures/seminars</p> <p>Take time to work on your progress review and firm down a topic and an argument for your catalogue entry.</p>
Lecture 20 Feb	Lecture 6 – Representation in the Age of Mechanical Reproduction
Seminars 22 Feb	<p>Readings: Daston and Galison</p> <p>This session will take place at the UCL Art Museum</p>
	<p>Art Museum + UCL Science Collections combined session!</p> <p>This week we will look at examples of ‘mechanical objectivity’ from the UCL Science Collections in our live seminars. Some of these objects will take us out of our comfort zone. In particular, they will invite us to think critically about the material traces of science’s colonial and racist past in the UCL archives</p>

	and collections. Be prepared to think about the challenging question of how should we approach objects and artefacts that speak of this problematic legacy at UCL.
Lecture 27 Feb Seminars 29 Feb	<p>Lecture 7 – Modernist Visions</p> <p>Readings: Henderson <u>or</u> Galison</p> <p>This seminar will take place in our allocated teaching room (see UCL Timetable)</p> <hr/> <p>Your task for this week:</p> <p>‘Modernism’ can mean many things. Science seems to play a role in several definitions of modernism in the literature. Pick an image or object that exemplifies your interpretation of ‘modernism’, and bring it to the seminars. We will discuss it with the rest of the class.</p>
Lecture 5 March, Seminars 7 March	<p>Lecture 8 – Representing Time: Seriality and Duration</p> <p>Readings: Canales</p> <p>This week’s seminars will take place in the UCL Art Museum</p> <hr/> <p>Your task for this week: <u>Think about time</u>, and how you would reconcile Bergson’s views of duration with the work we have done on images throughout the module. Is there any way in which a static image can be experienced as a duration? Can you think of how Bergson would go about it? Bring your thoughts to the seminars.</p>
Friday 8 March	Progress Report Due at 5pm
Lecture 12 March Seminars 14 March	<p>Lecture 9 – Visualisation Lost and Regained</p> <p>Readings: Galison</p> <p>This week’s seminar will take place in our regular teaching room.</p> <hr/> <p>Your task for this week: Do you have a “suppressed” drawing (in Galison’s sense), which helped you work out a particularly complex concept in your field? What material traditions is that drawing “folding in”? Bring it to the seminars, and us a bit about how you think it resonates with this week’s readings.</p>
Lecture 19 March Seminars 21 March	<p>Note: Chiara will be at a conference at the end of this week this week. The lecture on Tuesday will go ahead as normal. The Art Museum will be open as usual for your seminars on Thursday, and there will be objects on display for you – Chiara will not be there, but the curators can answer questions about the objects. Make sure you organise your own discussion, and don’t miss this last opportunity to spend time with some important artworks from the UCL Collections!</p> <p>Lecture 10: The Future of Representations</p> <p>Readings: Daston and Galison</p> <p>This seminar will take place at the Art Museum</p>

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Assessments

Summary

	Description	Deadline	Word limit
Coursework	Progress Report (formative)	Friday 8 March, 5pm	1000 words
Coursework	Catalogue Entry (100%)	Thursday 18 April, 5pm	4,000 words

Assessments

The assessment for this course is project-based. This means that you will have to do the thinking once, and settle on a topic you will research throughout the term. You will submit an assessed Progress Report (1000 words, formative), which will allow you to obtain preliminary feedback. You will then submit your final project (4000 words, 100% of your mark) after Easter.

Specific Guidelines and Criteria for Assessment for this Module:

Imagine you were asked to write an essay on an object/image of your choice for the catalogue of an exhibition revolving around the theme of art and science. What object, artefact, or image would pick, and why?

The assessment for this course consists in experimenting with the art of catalogue writing: a kind of writing where images and text, history, philosophy, and criticism should all be in dialogue with each other. The assessment is divided in two parts:

1. A progress report on the project you have chosen to research (1000 words)

This is a way to obtain feedback on the start of your project, with very little at stake (it will not count toward your mark). What I ask is a short synopsis of the topic you plan to explore in your catalogue entry (see also instructions on the catalogue entry below), the approach/methodology you intend to develop, and a brief review of the literature you have consulted so far. What research question(s) is your project going to ask? How are you building on the existing literature? What is your argument, and what is the evidence/archival sources you will use to support it? These are the questions you might want to keep in mind while writing your progress report.

Progress report expectations

[These are based on the general STS marking Criteria for Postgraduate Coursework which I will use to mark your final catalogue entry, and which you will find in the STS Student Handbook].

At this stage, your progress report should demonstrate:

- That you have located an object or an image connected to one of the topics covered in the module, and you have begun researching it.
- You have located relevant literature on it, and are examining it critically (i.e. you can describe what the literature says, and evaluate different arguments/approaches to a particular topic).
- You are developing a sustainable and coherent argument based on evidence from primary and secondary sources about your chosen object or image.

From this early stage, you want to demonstrate advanced critical and analytical thinking, in the form of a clear and coherent line of argumentation (keeping in mind that you will develop your argument further in your finished project). Your argument can be historical or philosophical or an integration of the two – but it needs to be an argument, not just a description or a list of interesting things about an image or object.

2. Your catalogue entry (4000 words, 100% of your mark)

This is the main piece of assessment for this course, and it revolves around a relatively well established academic genre: exhibition catalogues. It is not uncommon these days to find exhibition catalogues that go well beyond collections of images and captions in a book. Most catalogues nowadays include critical essays by experts, who connect particular objects in an exhibition to broader historical, philosophical and curatorial issues. Your project will consist in writing just such an essay – a contribution to a possible exhibition catalogue that examines an object or image that you have researched in detail.

The moodle page for the course gives you a few examples of catalogues published after various kinds of exhibitions, and you will find a lot more examples in libraries and museum bookstores (the V&A, Tate Modern, the British Museum, the Natural History Museum etc.).

The main task of this assessment is to find an artwork/scientific image/instrument/artefact and connect it to broader themes and debates in history and philosophy of science, history of art and criticism, aesthetics or any other of the topics we explored in the course. In the assessment tab on Moodle you will find a few examples of successful catalogue entries from previous years. Please look at them carefully, and try to think about what those previous students have done well in their work (and what you would improve on). Some students found the time to play around with the appearance and formatting of their entries (there is one example of that in moodle). You are welcome to experiment – especially if it helps with the integration of images and text – but you will not be marked on the appearance and formatting style of your catalogue entry. Prioritise the argument, and leave the formatting for later, if you have time and energy left!

It is essential that you communicate with me at the various stages of your project. You have a great deal of freedom and are welcome to pick a topic of your choice, but please make sure you agree on a topic with me well in advance. Ideally, I would like your projects to revolve around the UCL Museums and Collections – keeping in mind that you will use the collections as the starting point of your research and move beyond that in your projects.

Marking criteria and expectations

[These are based on the general STS marking Criteria for Postgraduate Coursework, which you will find in the STS Student Handbook].

Your final catalogue entry should demonstrate:

- a. Sustained and independent research on an object or image related to one of the topics we examined through the module.
- b. The presence of a *theoretical framing* (philosophical, historical/historiographical, or an integration of the two), grounded in the literature you have studied, and which will help you formulate your argument clearly and coherently;
- c. A clear connection with science (construed of course broadly, and approached from an interdisciplinary perspective), even in the case of a case-study from art.
- d. An argument: what particular perspective are you advancing on your chosen topic? what evidence are you using in support of your claims? and how does your account differ from what has been discussed in the literature? What is *original* in your approach?

Remember that originality is always grounded in evidence and in the literature: in order to demonstrate that your approach differs from what has already been said, you need to present, discuss and evaluate the literature first, and give evidence in support of your interpretation and argumentation.

A note on AI in assessment: this assessment falls under [Category 1 of UCL's guidelines on using AI tools in assessment](#): **AI tools cannot be used** (not even in an assistive function). This is because the skills you are gaining from this module include writing skills, planning, organising, and structuring content into a clear and coherent argument. You are being assessed on the process of structuring and writing down your argument, as well as on its content – using AI for that would mean missing out on those very important skills.

You must submit all the coursework in order to complete this module.

Please see separate documents on Moodle with detailed instructions for each assessment.

Departmental Criteria for Assessment

The departmental marking guidelines for individual items of assessment can be found in the STS Student Handbook.

Aims & objectives

The aim of this course is to explore the notion of “representation” as a crucial link between scientific and artistic visual practices. Drawing on a variety of interpretative tools from analytical and continental philosophical traditions, the course will address a range of philosophical questions arising from the parallel histories of representations in science and art. These will include issues concerning the nature and role of visual representations in scientific and artistic practice, the relationship between science and modernism, what counts as “objective” and “accurate” representation and when and how images count as “evidence” in the sciences.

By the end of the course, students will have acquired the necessary analytical and interpretative tools to engage critically with a broad range of visual materials and to establish interdisciplinary parallels between representations in science and in the visual arts.

Annotated Reading list

Lecture 1 – Introduction: Why Representation?

In this lecture, we begin to explore the historicized account of representation that we will use as a methodological framing for the entire module. We take the period between 1880 and 1918 as a crucial starting point: this was a time in which the very practice of representing, in art as well as science, undergoes a dramatic shift. Join Chiara – through Stephen Kern’s masterful *The Culture of Space and Time* - in a wonderful journey through fin de siècle Europe and America, when art and science collided in dramatic and powerfully changing ways.

Essential Readings

Stephen Kern, *The Culture of Time and Space 1880-1914*, Cambridge, Mass.: Harvard University Press, 1983.

(Read the Introduction; choose one chapter between Chapter 1 “The Nature of Time” and Chapter 6 “The Nature of Space”).

Please also read the course syllabus closely. Pay special attention to the descriptions under each lecture title, which give you a sense of the overall narrative I have adopted for the module. Read also the description of the assessments, and note down any questions you have on them. There will be a dedicated forum on assessments where we will discuss them. Having a clear overview of how a module operates and what is expected from you will make everything easier and smoother throughout this term!

Part 1: How do Representations ‘Represent’ (and is it worthwhile asking this question?)

Lecture 2 –Denotation, Convention, and the Riddle of Style

The late nineteenth and early twentieth century called into question a much earlier, common-sense view of representation as ‘mimesis’. In this session we explore two conceptual positions, from aesthetics and from history of art respectively, which contributed to the

(ongoing!) philosophical scepticism toward the concept of mimesis: Nelson Goodman's account of 'denotation' and Ernst Gombrich's revival of conventions in artistic 'making and matching'. Goodman and Gombrich's views will return in lecture 5, where we will explore how contemporary philosophers of science 'rediscovered' them while tackling issues of scientific representation and scientific modelling.

Essential Readings

Choose one of the following:

Nelson Goodman, *Languages of Art*. Indianapolis: Hackett, 1976.
(Introduction; Chapter 1 "Reality Remade". You might want to consider also the following extracts from chapter 2: "Exemplification" (pp. 52-57) and "Samples and Labels" (pp. 57-68).

Ernst Gombrich, *Art and Illusion* London: Phaidon, 1960.
("Psychology and the Riddle of Style" (introduction); Chapter 2 "Truth and the Stereotype")

Further Readings

Goodman and Gombrich have been influential figures in aesthetics and history of art, and the literature on/by them is really vast. Below you will find a few annotated sources, but you can find much more through the UCL Catalogue.

Electronic Access:

Douglas Arrell, "What Goodman Should Have Said about Representation", in *The Journal of Aesthetic and Art Criticism*, vol. 4, no. 1 (1987), pp. 41-49.

Alessandro Giovannelli, "Goodman's Aesthetics", *The Stanford Encyclopedia of Philosophy* (Summer 2010 Edition), Edward N. Zalta (ed.), URL=<http://plato.stanford.edu/archives/sum2010/entries/goodman-aesthetics/>

Catherine Elgin, "Reorienting Aesthetics, Reconceiving Cognition", *Journal of Aesthetics and Art Criticism*, vol. Vol. 58, No. 3 (Summer, 2000), pp. 219-225.

Jenefer Robinson, "Languages of Art at the turn of the Century", *Journal of Aesthetics and Art Criticism*, vol. Vol. 58, No. 3 (Summer, 2000), pp. 213-218.

Note: this issue of the *Journal of Aesthetics and Art Criticism* contains a whole symposium section on Nelson Goodman's *Languages of Art* and his contributions to aesthetics.

Andrew Hemmingway, "E.H. Gombrich in 1968: Methodological Individualism and the Contradictions of Conservatism", *Human Affairs: A Postdisciplinary Journal for Humanities & Social Sciences*, vol. 19 no. 3 (2009), pp. 297-303.

Norbert Schneider, "Form of Thought and Representational Gesture in Karl Popper and E.H Gombrich", *Human Affairs: A Postdisciplinary Journal for Humanities & Social Sciences*, vol. 19 no. 3 (2009), pp. 251-258

James Elkins, "Ten Reasons why E.H. Gombrich is not Connected To Art History", *Human Affairs: A Postdisciplinary Journal for Humanities & Social Sciences*, vol. 19 no. 3 (2009), pp. 304-310.

Note: this issue of *Human Affairs* is entirely devoted to a historical and critical reappraisal of Gombrich. The first two articles listed above are about Gombrich and Popper in particular. The third article by James Elkins discusses Gombrich's wider interest in science – especially psychology – and offers some possible reasons of his marginal treatment in contemporary history of art.

Christopher Wood, "E.H. Gombrich's Art and Illusion: A Study in the Psychology of Pictorial Representation, 1960", *The Burlington Magazine*, vol. 151 no. 1281 (2009), pp. 836-839.

Note: One of my favourite articles about Gombrich. It shows the interdisciplinary nature of his thinking and places him in dialogue with philosophy of science, semiotics and broader trends in history of art. Read it hand in hand with the piece by Elkins listed above.

Not available electronically but in the UCL Library

Books on/by Nelson Goodman:

Nelson Goodman, *Ways of Worldmaking*, New York: Hackett, 1978.

Catherine Z. Elgin, *Nelson Goodman's Philosophy of Art*. New York: Garland Publishing, 1997.

Richard Rudner and Israel Scheffler (eds.). *Logic and Art: Essays in Honor of Nelson Goodman*. Indianapolis: Bobbs Merrill, 1972.

Books on/by Ernst Gombrich:

Ernst Gombrich, *Meditations on a Hobby Horse*. London: Phaidon, 1963.

Ernst Gombrich, Julian Hochberg and Max Black, *Art Perception and Reality*. Baltimore: The John Hopkins University Press, 1972.

Ernst Gombrich and Didier Eribon, *Conversations on Art and Science*. New York: Abrams, 1993.

Paul Taylor (ed.) *Meditations on a Heritage*. London: The Warburg Institute and Paul Holberton Publishing, 2014.

Onions J. (ed.). *Sight & Insight. Essays in Honour of E.H. Gombrich*. London: Phaidon, 1994.

Lecture 3 – Representation, Classification and the Order of Things

This week we take a continental turn, and read a classic by Michel Foucault. There are a number of reasons why I want you to read extracts from *The Order of Things*. First of all, the book's introduction provides an eye-opening description of Velasquez's *Las Meniñas*, an extraordinary painting which had received scant scholarly attention until Foucault decided to open his book with a description of it. Secondly, Foucault's description of the painting is an exceptional example of how you can navigate an image and explore its multiple layers and perspectives from within. But Foucault's philosophical text is also a way into exploring the question of representation from a distinctively historical perspective, and unearthing the deep contingency of what we have often taken as established and necessary truths. As we will see, echoes of a Foucaultian historical epistemology will resurface in Daston and Galison's account of objectivity, which we will explore in the coming weeks.

Essential Readings

Michel Foucault, *The Order of Things*. London: Routledge, 2002.

(Preface and extracts from part 1: 1. 'Las Meniñas'; 2.1 'The Four Similitudes'; 3. 'Representing')

Note: To be honest, this is one of those 'all or nothing' books: selecting extracts does not quite do it justice. Take Foucault's history with a pinch of salt, however: historians have heavily criticized his use (or lack thereof!) of historical evidence – especially his patchy use of primary sources. Focus instead on the philosophical method that emerges from his use of history, and pay attention to the way in which historical understanding is woven into his philosophical arguments.

Further Readings

As you can imagine, the literature on/by Foucault is endless! Here is just a small taster – you will find a lot more even just with a simple search through the UCL Catalogue.

Available Electronically:

On Foucault:

Gary Gutting (ed.), *The Cambridge Companion to Foucault*, Cambridge: Cambridge University Press, 1994.

Gutting, Gary and Oksala, Johanna, "Michel Foucault", *The Stanford Encyclopedia of Philosophy* (Summer 2018 Edition), Edward N. Zalta (ed.), URL = <https://plato.stanford.edu/archives/sum2018/entries/foucault/> .

Catherine Soussloff, *Foucault on Painting*, Minneapolis: University of Minnesota Press, 2017.

Note: requires familiarity with Foucaultian concepts, but it is ideal if you would like to explore Foucault's 'philosophy of art' - as it were – and his writings on art and artists beyond Velasquez in greater detail. *Las Meniñas* features prominently in the book – see especially the introduction

and the first chapter.

On Velasquez's *Las Meniñas*:

Svetlana Alpers, "Interpretation without Representation, or the Viewing of *Las Meniñas*", in *Representations*, vol. 1 (1983), pp. 30-42.

John Searle, "Las Meniñas and the Paradoxes of Pictorial Representation" in *Critical Inquiry* vol. 6 no. 3 (1980), pp. 477-488.

Note: Recommended if you are fed up with this week's continental style and want a clear and crisp analytical reading of Velasquez's painting!

Kelly Grovier, "Velázquez's *Las Meniñas*: A detail that decodes a masterpiece", BBC Culture, 16 October 2020, available at: <https://www.bbc.com/culture/article/20201015-velzquezs-las-meniñas-a-detail-that-decodes-a-masterpiece>

Note: A popular piece, so follow-up the evidence it contains and try to find additional academic sources if you want to use it for a project. Not sure I agree with the claim that the detail 'decodes' Velasquez's painting, but it certainly adds a whole new perspective to it – one I had not thought about before coming across this article!

Not available electronically but in the UCL library

Foucault, Michel, *This is Not a Pipe*, translated and edited by James Harkness. Berkeley: University of California Press, 1983.

Note: Foucault's famous essay on Magritte. The UCL library copy is in the stores (it is not too difficult to request it!), but there are also affordable copies available for purchase online. A must-have if you are a fan of the Foucault-and-art combination!

Johanna Oksala, *How to Read Foucault*, London: Granta Books 2007.

Note: a quick and snappy guide to Foucault, starting from extracts of his main writings.

Svetlana Alpers, *The Art of Describing. Dutch art in the seventeenth century.* (Chicago: University of Chicago Press, 1983).

Note: Another way of "historicizing" representations, in a manner that is somehow complementary to Foucault's. Goes very well as a bridge between last week's and this week's sessions.

Lecture 4 – Before Objectivity: Truth-to-Nature

This week we travel to the Early Modern period and begin considering the philosophical implications of thinking historically about what counts as 'accurate depiction'. This session is your introduction to a book that will accompany us throughout the rest of this module – Daston and Galison's *Objectivity* – and that hopefully will equip you with new ways of seeing and thinking about image-making in the sciences.

Essential Readings

Lorraine Daston and Peter Galison, *Objectivity*. New York: Zone Books 2007.
(Chapter 2, Truth-to-Nature)

Note: Yes. It is very long. It is very convoluted. It takes a bit to get used to the language. But we don't like easy, do we? Also, you have read Foucault last week – you can read anything you set your mind to now!

Further Readings

Available Electronically:

More by Daston and Galison:

Lorraine Daston, "Objectivity and the Escape from Perspective", in *Social Studies of Science*, vol. 22, no. 4 (1992), pp. 597-618.

Lorraine Daston and Peter Galison, "The Image of Objectivity", in *Representations*, no. 40 (1992), pp. 81-128.

Note: SPOILER ALERT!!! Gives away the account of 'mechanical objectivity' that we will cover

under lecture 6. But it is also a good summary of the central claims of the book. Up to you to decide if you want to get to that now, or wait until Lecture 6.

Observation and its History:

Lorraine Daston “On Scientific Observation”, in *ISIS*, vol. 99, no. 1 (2008), pp. 97-110.

Patrick Singy “Huber’s Eyes: The Art of Scientific Observation before the Emergence of Positivism”, *Representations*, vol. 95, no. 1 (2006), pp. 54-75.

Early Modern Skeletons; Observed and Imagined Bodies:

Londa Schiebinger, “Skeletons in the Closet: The First Illustrations of the Female Skeletons in Eighteenth-Century Anatomy”, *Representations*, vol. 14 (Spring 1986), pp. 42-82.

Note: check out the whole issue of *Representations* where this article appear, if you are interested in representations of the body in the eighteenth and nineteenth centuries.

Reinhard Hildebrand, “Attic Perfection in Anatomy: Bernhard Siegfried Albinus (1697–1770) and Samuel Thomas Soemmerring (1755–1830)”, *Annals of Anatomy*, 187, vols 5-6 (2005), pp. 555-573.

The Story of Wandelaar’s Rhino (and more spoilers about *Objectivity!*)

Chiara Ambrosio, “Objectivity and Representative Practices across Scientific and Artistic Visualisation”, in A. Carusi et al. *Visualisation in the Age of Computerisation*, London: Routledge 2014, pp. 118-144.

Not available electronically but available in the UCL Library

Lorraine Daston and Elizabeth Lunbeck (eds.), *Histories of Scientific Observation*. Chicago and London: University of Chicago Press, 2011.

Note: see especially Part 1: “Framing the History of Scientific Observation, 500-1800)

Lorraine Daston and Peter Galison, “Epistemologies of the Eye”, in *Objectivity* (New York: Zone Books 2007), pp. 17-51.

Peter Galison and Caroline Jones, *Picturing Science, Producing Art*. New York and London: Routledge, 1998

Note: lots of copies of this book in the UCL Library! For this session, see especially Part 3, “Seeing Wonders”

Lecture 5 – The Conundrum of Representation in Philosophy of Science

This week we come back to the present, and explore how philosophers of science have been revisiting the issue of representation over the past decade. We will explore the problematic status of “similarity” in current debates on scientific representation and see how it compelled philosophers of science to step out of the boundaries of their discipline and actively look at art and aesthetics. But precisely through this conceptual comparison between artistic and scientific representations, we will also ask whether and in what sense “similarity” or mimetic accounts of representation are *really* the villain in all this story.

Essential Readings

Roman Frigg and Matthew Hunter (eds.) *Beyond Mimesis and Convention: Representation in Art and Science* Dordrecht: Springer, 2010. (Read the Introduction)

Mauricio Suárez, “Scientific Representation”, *Philosophy Compass* (2010) vol. 5, no. 1, pp. 91-101.

Further Readings

Available Electronically:

Ambrosio, C. “Iconic Representations and Representative Practices”, *International Studies in Philosophy*

of *Science*, vol. 28 (3), 2014, pp. 255 – 275.

Note: My attempt at defending similarity, via Charles S. Peirce's conception of iconicity. I would probably write the section on homomorphism very differently now, but I still agree with most of my own argument (pewh!)

Otávio Bueno, George Darby, Steven French and Dean Rickles, *Thinking about Science, Reflecting on Art*, London: Routledge, 2017.

Roman Frigg and James Nguyen, "Scientific Representation", *The Stanford Encyclopedia of Philosophy* (Spring 2020 Edition), Edward N. Zalta (ed.), URL = <https://plato.stanford.edu/archives/spr2020/entries/scientific-representation/> .

Ian Hacking, *Representing and Intervening*. Cambridge: Cambridge University Press, 1983.

Mary Morgan and Margaret Morrison (eds.). *Models as Mediators. Perspectives on Natural and Social Science*. Cambridge: Cambridge University Press, 1999.

Julia Sánchez-Dorado "Methodological Lessons for the integration of Philosophy of Science and Aesthetics", in O. Bueno et al. *Thinking about Science, Reflecting on Art*, London: Routledge, 2018, pp. 10-26.

Bas van Fraassen, *Scientific Representation: Paradoxes of Perspective* Oxford: Oxford University Press, 2008.

Andrea Woody, 2014. "Chemistry's Periodic Law: Rethinking Representation and Explanation after the Practice Turn" Lena Soler, Sjoed D. Zwart, Michael Lynch, and Vincent Israel-Jost (eds.) *Science After the Practice Turn in the Philosophy, History, and Social Studies of Science*. New York and London: Routledge, pp. 123-150.

Oldies but goodies But in the UCL or Senate House Libraries

Max Black, *Models and Metaphors*. Ithaca and New York: Cornell University Press, 1966.

Mary Hesse, *Models and Analogies in Science*, Notre Dame: Indiana University Press, 1966.

A weird one:

What would philosopher of science Paul Feyerabend have to say about representations across art and science? I have just written an essay about it. Ask me a pre-print if you are interested!

Chiara Ambrosio, "Feyerabend on Art and Science", forthcoming in In K. Bschor, J. Shaw (Eds.), *Interpreting Feyerabend: Critical Essays*. Cambridge: Cambridge University Press.

Break – Reading week

We will take a break during reading week. Use this week to catch-up with the readings, revisit images/objects that have intrigued you during this first half of the module, and work on your Progress Report!

Part 2 – Representations in Action

Well done – you've made it through the testing first half of this module. I hope you are still with me for the second half – now that you have started thinking in images and objects, the real fun begins!

Lecture 6 – Representation in the age of Mechanical Reproduction

The extraordinary rise of recording instruments and devices in the mid-nineteenth century brought about a range of dramatic changes in science as well as art. It is at this historical junction, Lorraine Daston and Peter Galison argue, that 'objectivity' emerges as an epistemic virtue in its own right. This week we explore their account of objectivity in relation to a most

exemplary case in visual culture: the case of photography.

Essential Readings

Lorraine Daston and Peter Galison, *Objectivity*. New York: Zone Books, 2007.
(Read Chapter 3, Mechanical Objectivity)

Further Readings

The history and aesthetics of photography are – again! – really vast fields. So, once more, here is a taster and if you would like to work on this topic let's talk more, and I will be happy to make additional suggestions.

Available Electronically:

Chiara Ambrosio, "Composite Photographs and the Quest for Generality: Themes from Peirce and Galton", *Critical Inquiry* vol. 42 no 3 (2016), pp. 547-579.

Chiara Ambrosio, "'Beauty is the Universal Seen': Objectivity as Trained Vision in Alfred Stieglitz's Experimental Aesthetics", *Visual Studies* vol. 29 no. 3 (2014), pp. 250-260.

Josh Ellenbogen, "Camera and Mind", *Representations*, vol. Vol.101 no. 1 (2008), pp.86-115.
A fantastic historical analysis of the genealogy and legacy of the trope of the mind as a camera.
Great if you plan to work on Marey.

Peter Geimer, "Image as Trace: Speculation about an Undead Paradigm", in *differences*, vol. 18, no. 1 (2007), pp. 7-28.

Carlo Ginzburg, "Family Resemblances and Family Trees: Two Cognitive Metaphors", *Critical Inquiry*, vol. 30 no. 3 (2004), pp. 537-556.

Note: One of my favourite essays on composite photographs. And generally, reading Carlo Ginzburg is an absolute intellectual treat!

Aud Sissel Hoel, "Measuring the Heavens: Charles S. Peirce and Astronomical Photography", *History of Photography*, vol.40 no. 1 (2016), pp.49-66.

Note: for those of you brave enough to be interested in Peirce, this is a wonderful essay on his use of photography in astronomical measurement.

Andreas Mayer, "The Physiological Circus: Knowing, Representing and Training Horses in Motion in Nineteenth Century France" *Representations*, vol. 111, no. 1 (2010), pp 88-120.

Joel Snyder, "Picturing Vision", *Critical Inquiry* vol. Vol. 6, No. 3 (Spring, 1980), pp. 499-526.

Note: A classic in theory and aesthetics of photography. Brings beautifully together debates in part 1 of our course (especially Gombrich and Goodman) and the practice-based approach we are developing in part 2. Highly recommended if, like me, you enjoy that feeling of completeness coming from things falling into place neatly!

Not available electronically but in the UCL or Senate House Libraries

Walter Benjamin, *Illuminations*. London: Pimlico, 1999.

Note: this collection of essays contains "The Work of Art in the Age of Mechanical Reproduction". The UCL library has six different editions/versions of this book, but none of them is available electronically, unfortunately!

Susan Sontag, *On Photography*. London: Penguin Classics 2008

Note: again, plenty of copies in the library but alas – none available electronically. A book worth having, however, if you are interested in photography. There are fairly affordable paperback copies on sale online.

Joel Snyder, "Visualisation and Visualizability", in Peter Galison and Caroline Jones (eds.), *Picturing Science, Producing Art*. New York and London: Routledge, 1998.

Note: If you plan to work on Marey and/or if you would like to read a thorough response to Daston and Galison, this is a great source!

Jennifer Tucker, *Nature Exposed*, Baltimore: The Johns Hopkins University Press, 2005.

Note: A wonderful history of Victorian photography and scientific evidence.

Kelley Wilder, *Photography and Science*, London: Reaktion Books 2009.

Note: An excellent introduction to conceptual, historical and historiographical issues

surrounding the relationship between photography and science.

Lecture 7 – Modernist Visions

This week, we explore two senses of 'Modernism'. Part one of this week's lecture takes us to Paris at the beginning of the twentieth century, where we explore how artists responded to foundational questions about the nature of space. What I find truly fascinating about this particular chapter in the history of art and science is the fact that the roots of artists' reformulation of space in painting as well as sculpture are precisely in what they thought they thought they were breaking away with: the previous century. In part two, we move between Vienna and Dessau, and look at the relationship between the Bauhaus and the members of the Vienna Circle – the very movement that helped establish philosophy of science as a field of inquiry in its own right.

Essential Readings

Choose one of the following (you can use the remaining article as optional reading):

Linda Dalrymple Henderson, "X-Rays and the Quest for Invisible Reality in the Art of Kupka, Duchamp and the Cubists", in: *Art Journal* vol. 47 (1988) pp. 323-340.

Peter Galison, "Aufbau/Bauhaus: Logical Positivism and Architectural Modernism" in *Critical Inquiry*, Vol. 16, no. 4 (1990), pp. 709-752.

Note: This is a long paper. But it is a rollercoaster – and a great one. Strongly recommended if you are interested in architecture, or in the history of philosophy of science, or ideally in both.

Further Readings

Available Electronically:

Chiara Ambrosio, "Cubism and the Fourth Dimension", in *Interdisciplinary Science Reviews*, vol. 41, no 2-3 (2016), pp. 202-221.

Note: Me again! Sorry. But this may be useful if you would like to get a sense of where the literature, and especially the historiography on Cubism and the fourth dimension stand currently.

Willard Bohn, "Writing the Fourth Dimension", *Comparative Critical Studies* vol. 4 no. 1 (2007), pp. 121-138.

Note: if you are interested in how the fourth dimension filtered into writers' and poets' works this paper is for you!

Robert Bud, Paul Greenhalgh, Frank James, and Morag Shiach (eds), *Being Modern*. London: UCL Press, 2018.

Note: An excellent collection, which explore the categories of modernism and modernity from the perspective of the history of science.

Linda Dalrymple Henderson, "Editor's Introduction – Writing Modern Art and Science", in *Science in Context*, vol. 17 no. 4 (2004), pp. 423-466.

Note: you can use this special issue of *Science in Context* as a source of further material on Modernism and Science

Gerald Holton, "Henri Poincaré, Marcel Duchamp and Innovation in Science and Art", in *Leonardo*, vol 34 no. 2 (2001), pp. 127-134.

Stephen Kern, *The Culture of Time and Space 1880-1918*, Cambridge, Mass.: Harvard University Press, 1983.

Revisit Chapter 6, and see if it makes more sense now!

Vincent Sherry (ed.), *The Cambridge History of Modernism*. Cambridge: Cambridge University Press, 2017.

Note: this is a fantastic resource. It looks at modernism from a global and truly integrated perspective, including perspectives on modernism and race, gender, colonialism and cultural appropriation. It is an absolute luxury to have online access to it via the UCL library! Definitely a source you want to consult and use, if you are interested in modernism from an interdisciplinary perspective.

On the Bauhaus:

Laura Forlano, Molly Wright Stevenson, Mike Ananny (eds.) *Bauhaus Futures*. Cambridge: Mass.: The MIT Press.

Note: a useful and diverse collection. Some chapters link the Bauhaus' design practice explicitly to themes and concepts from STS. Worth a browse at least, if you are interested in architectural modernism (and it will lead to more literature – just follow the bibliographies to each chapter!)

Not available electronically but in the UCL or Senate House Libraries

Lorraine Daston and Peter Galison, *Objectivity*, New York: Zone Books, 2007.

Note: check especially chapter 5, “Structural Objectivity”

Linda Dalrymple Henderson, *The Fourth Dimension and Non-Euclidean Geometry in Modern Art*, Princeton: Princeton University Press, 1983). See also the second edition, MIT Press 2013.

Note: the *ultimate* source on the fourth dimension in art. If you are interested in this topic, her book is a must!

Peter Galison, Gerald Holton and Silvan Schweber (eds.), *Einstein for the 21st Century: His Legacy in Science, Art and Modern Culture*. Princeton: Princeton University Press, 2008.

Note: A great source if you want to know what happened once Einstein's relativity *did* make it into art and popular culture.

Arthur I. Miller, *Insights of Genius*. Cambridge, Mass.: The MIT Press, 2000.

Arthur I. Miller, *Einstein, Picasso. Space, Time and the Beauty that Causes Havoc*. New York: Basic Books, 2001.

Gavin Parkinson, *Surrealism, Art and Modern Science. Relativity, Quantum Mechanics, Epistemology*. New Haven and London: Yale University Press, 2008.

Lecture 8 – Representing Time: Seriality and Duration

A confession: this week's topic is my excuse to teach one of my favourite philosophers, Henri Bergson. But the choice is not completely whimsical or too far-fetched: at the beginning of the twentieth century Bergson was a leading intellectual figure in France and beyond, with a remarkable influence upon artists as well as scientists. In this session we explore this influence in detail, and also think critically about the reasons of the eclipse of Bergson's philosophy (and rejoice for its recent revival!)

Essential Readings:

Jimena Canales “Desired Machines: Cinema and the World in Its Own Image”, in *Science in Context*, no. 24 vol. 3 (2011), pp. 329-359.

Further Readings

Available Electronically:

Suzanne Guerlac, *Thinking in Time: An Introduction to Henri Bergson*, Ithaca: Cornell University Press, 2006.

Note: A little more complex than the Introduction by Mark Sinclair (details below), but focused specifically on time in Bergson.

Stephen Kern, *The Culture of Time and Space 1880-1918*, Cambridge, Mass.: Harvard University Press, 1983.

Note: Revisit Chapter 1, and see if it makes more sense now!

Alexandre Lefebvre and Nils Scott (eds), *Interpreting Bergson*. Cambridge: Cambridge University Press 2019.

Note: A new collection with commentaries to key aspects of Bergson's philosophy by Bergson scholars. If you are interested in time, read the chapter authored by Suzanne Guerlac. There is a good chapter on Bergson's philosophy of art authored by Mark Sinclair (who is also the author of

the introduction to Bergson listed below).

Mark Sinclair, *Bergson*, London: Routledge 2019.

Note: A much anticipated, clear and easy introduction to Bergson's philosophy. Highly recommended if you would like to see the bigger picture of Bergson's ideas – including his philosophy of science and philosophy of art.

More 'desired machines'

Jimena Canales, "Photogenic Venus: The " Cinematographic Turn " and Its Alternatives in Nineteenth-Century France", *ISIS* vol. Vol. 93, No. 4 (December 2002), pp. 585-613.

Jimena Canales, "Movement before Cinematography: The High-Speed Qualities of Sentiment", *Journal of Visual Culture* vol. 5 no. 3 (2006), pp. 275-294.

Bergson in Art

Mark Antliff "The Fourth Dimension and Futurism: A Politicised Space", in *Art Bulletin*, vol 82 no. 4 (2000), pp. 720-733.

Mark Antliff, "Shaping Duration: Bergson and Modern Sculpture", *The European Legacy* vol.16 no.7 (2011), pp. 899-918.

The Einstein-Bergson Controversy

Unfortunately the UCL library does not give you electronic access to Jimena's Canales' wonderful book *The Physicist and the Philosopher* (details below). However, you can find an informative preview of some of the themes of the book in this chapter, available online via her website:

Jimena Canales, "Einstein's Bergson Problem: Communication, Consensus and Good Science", *Cosmological and Psychological Time*, ed. By Yuval Dolev and Michael Roubach, Boston Studies in the History and Philosophy of Science, vol 285 (2016), pp. 53-69. Available at:

<https://static1.squarespace.com/static/5b6888ca2714e5f98508920a/t/5b6de0a84fa51ad84abb6dba/1533927593559/Canales-Einsteins-Bergson-Problem-Communication-Consensus-and-Good-Science.pdf>

Not available electronically But available in the UCL or Senate House Library

Jimena Canales, *The Physicist and The Philosopher*. Princeton and Oxford: Princeton University Press, 2016.

Jimena Canales *A Tenth of a Second: A History*, Chicago and London: The University of Chicago Press, 2009.

Lecture 9 – Visualisation Lost and Regained

This week we move further into the twentieth century, to explore the fortunes and misfortunes of representation across formalisation and abstraction. Starting from Galison's study of Paul Dirac's suppressed drawings, we look more broadly at how geometry, diagrams and drawings were conceptually suppressed and subsequently revived, as a result of scientists' as well as artists' shifting epistemological and metaphysical commitments.

Essential Readings

Peter Galison, "The Suppressed Drawing: Paul Dirac's Hidden Geometry", *Representations*, no. 72 (2000), pp. 145-166.

Further Readings

Lorraine Daston and Peter Galison, *Objectivity*, New York: Zone Books 2007 (the chapters on Structural Objectivity and Trained Judgment are especially helpful for this week's session)

On drawing in art and science see Gemma Anderson-Tempini and John Dupré (eds), *Drawing Processes of Life: Molecules, Cells, Organisms*. Chicago: Intellect, 2023 (open access).

Available Electronically:

The literature on diagrams is booming. If you are interested in the topic there are two recent special issues that give you an overview of current debates:

“Tools of Reason: The Practice of Scientific Diagramming from Antiquity to the Present”, edited by Greg Priest, Paula Findlen and Silvia de Toffoli, *Endeavour* vol. 42, issues 2-3 (2018), pp. 49-188.

“Thinking and Acting with Diagrams”, edited by Hsiang-Ke Chao and Harro Maas, *East Asian Science, Technology and Society* vol. 14 no. 2 (2020), pp. 191-376.

Chiara Ambrosio, “Toward and Integrated History and Philosophy of Diagrammatic Practices”, *East Asian Science, Technology and Society*, vol. 14 no. 2 (2020), pp. 347-376.

Note: This is my article in the EASTS special issue listed above. Brace yourself for a mini-monograph on diagrams, which of course includes an entire section on Peirce! The first section can be useful, if you are interested in a historical and historiographical argument about the fortunes and misfortunes of diagrams in epistemology and philosophy of science in the late nineteenth and early twentieth century.

David Kaiser, “Stick-Figure Realism: Conventions, Reification and the Persistence of Feynman Diagrams”, in *Representations*, no. 70 (2000), pp. 49-86.

Bruno Latour, “Visualisation and Cognition: Drawing Things Together”, in Henrika Kuklik (ed), *Knowledge and Society: Studies in the Sociology of Culture Past and Present*, vol. 6. Greenwich, Conn: Jai Press, pp. 1-40. Available electronically at <http://www.bruno-latour.fr/sites/default/files/21-DRAWING-THINGS-TOGETHER-GB.pdf>

Note: This is a classic in visual culture. It is a rather long and complex piece; for the purpose of this session pay special attention to section 4 (“Capitalising Inscriptions to Mobilise Allies”), which neatly connects to some of the themes discussed this week.

Not available electronically but in the UCL or Senate House Libraries

Peter Galison, *Image and Logic*. Chicago: University of Chicago Press, 1997.

David Kaiser, *Drawing Theories Apart*, Chicago: The University of Chicago Press, 2005.

Arthur I. Miller, *Insights of Genius* Cambridge, Mass.: The MIT Press (2nd ed.).

Andrew Pickering, *The Mangle of Practice*, Chicago: The University of Chicago Press, 1995.

Warwick, Andrew, *Masters of Theory*. Chicago: The University of Chicago Press, 2003.

Lecture 10 Epilogue: The Future of Representations

Well, we got to the end of the road. But this is really only the beginning! In this session we explore a recent chapter in the story of representations: artists’ incursions in, and appropriation of, computer science and Artificial Intelligence. We will consider the current hype around ‘computer-generated art’ as the latest frontier of art-science collaborations, and place the grand claims of AI enthusiasts in a historical context. Without denying the potential of AI for creative practice, we will consider it in relation to – and as continuous with – the experimentations with technology that have characterised artists’ practices all along. This will also give us the opportunity to ask: what happens to representations, when science and art go digital?

Essential Readings

Lorraine Daston and Peter Galison, *Objectivity*, New York: Zone Books 2007, Chapter 7 (Representation to Presentation)

Further Readings

Available Electronically:

STS approaches to representation and visualisation:

Annamaria Carusi, Aud Sissel Hoel, Timothy Webmoor and Steve Woolgar (eds.), *Visualisation in the Age of Computerisation*, London: Routledge 2014.

Catelijne Coopmans, Janet Vertesi, Michael Lynch, Steve Woolgar, *Representation in Scientific Practice Revisited*. Cambridge, Mass. The MIT Press, 2014.

Computers, Cybernetics, AI and Art, then and Now:

Chiara Ambrosio, “Unsettling Robots and the Future of Art”, *Science* vol. 365 (6448), pp. 38-39.

Harold Cohen, “A Self-Defining Game for One Player: On the Nature of Creativity and the Possibility of Creative Computer Programs”, in *Leonardo*, vol. 35 no. 1 (2002), pp. 59-64.

Christiane Paul (ed). *A Companion to Digital Art*. Oxford: Wiley, 2016.

Note: a rich and really useful resource if you are interested in the role of science and technology in the movement toward digital art.

Andrew Pickering, “Cybernetics and the Mangle: Ashby, Beer and Pask”, *Social Studies of Science* vol. 32, No. 3 (2002), pp. 413-437.

Note: if you are interested in the relationship between cybernetics and the performing arts, look up also Pickering’s books – particularly *The Cybernetic Brain*, which has a whole section on the Cybernetic Serendipity exhibition. Pickering is a good source also if you are interested in the ‘ontological turn’ more broadly.

Rainer Usselmann, “The Dilemma of Media Art: Cybernetic Serendipity at the ICA London”, in *Leonardo*, vol. 36, no. 5 (2003), pp. 389-396.

Not available electronically but in the UCL or Senate House Library

Michael Lynch and Steve Woolgar *Representation in Scientific Practice*. Cambridge, Mass.: The MIT Press, 1990.

Note: this is the first, original edition – now a classic in STS and Visual studies. The ‘revisited’ edition is available electronically and listed above (Coopmans et al, 2014)

R. Hamblyn and M. J. Callanan, *The Data Soliloquies*. London: UCL Environment Institute, 2009.

Note: Not about cybernetics/computer art, but a great collaborative project on art and scientific data from a contemporary art practice perspective.

Andrew Pickering, *The Cybernetic Brain*, Chicago: The University of Chicago Press, 2009.

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All students taking modules in the STS department are expected to read these policies.
