

Histories of Art, Race and Empire: 1492-1865

Timothy Barringer, Paul Mellon Professor in the History of Art

How can we use works of art to explore difficult histories and better understand present-day issues in historical perspective? We often associate looking at works of art as a pleasure, one typically enjoyed by elite audiences. But if we look closely and carefully at paintings, drawings, prints and photographs—and even works such as maps and magazines not usually considered to be 'art'—we can all find powerful traces of the beliefs and practices of earlier generations. Looked at this way, museums become as important as libraries and websites for understanding the past.

This seminar will address a key question of our times: how have race and ethnicity have been understood throughout the history of North America, and how can works of art help us understand and critique this history? We will use original historical materials available on Yale's campus and in New Haven to explore these troubling questions. All images will also be made available digitally for future use. Working with real historical items will also model possible ways that teachers can use local museum collections and historic sites across the country for teaching. The class will also focus on how to look closely and critically at images. In a world where images on screens are dominant, skills of visual analysis and critique are ever more crucial.

We start by looking at the history of the British Empire, beginning with early efforts at colonization and encounters with Indigenous Americans in the sixteenth century. We will study works of art created by Indigenous people and representations of Indigenous life made by explorers and settler-colonists. A related topic is the British Empire in India and the growth of mercantile trade, the rise of "Orientalism" in portrayals of Asian cultures. We will also examine early representations of enslaved people and the history of slavery and the Middle Passage, focusing on the Caribbean, the American colonies and the early years of the USA. Art of great power and beauty was produced in many media by African Americans. Horrific images were also used effectively by the anti-slavery movement in Britain and the USA. Our final sessions will discuss the emergence of photography in the Civil War era, and the question of how "real" historical images can be.

These are sensitive issues for discussion and we will need to think together very carefully about language and pedagogical approaches. There is exciting new academic research to share, but the seminar leader has much to learn from members of the seminar as we work through this difficult but important material together.

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Writing About Nature

Jill Campbell, Professor of English

What is "Nature"? What is the impact of attention to nature on various forms of writing—poetry, fiction, memoirs, essays, scientific prose? In turn, what impact might writing in any or all of these forms have on the future of Earth's natural world—its animals, plants, ecosystems, and wild places? Does nature as a subject matter belong to some people and not to others? How can students in urban as well as rural settings have access to "Nature" as a part of their daily experience and as a subject for their own writing? What might attending to elements of nature in any setting offer a writer? Has writing about nature changed in the 21st century?

The seminar will address this range of open-ended questions by sampling writing about nature in a variety of genres from the 18th century to the present, exploring several long-standing literary conceptions of Nature: as a source of restoration and spiritual renewal; as a place of solitude and introspection; as a repository of deep cultural meaning and history; as a realm of wildness outside of social influence and artifice; as the site of scientific evidence, universal principles, and systems of knowledge.

The seminar will also consider the special urgency and challenge of thinking and writing about "nature" in our particular time—in the age of the Anthropocene, when the effects of human actions reach every corner of the Earth, including its oceans, as climate change threatens the balance of ecosystems everywhere and mass extinctions loom. We will sample texts in which an ecological awareness emerged from close, daily attention to the natural world, including works by Aldo Leopold and Rachel Carson, as well as more recent statements on climate change by writers such as Dipesh Chakrabarty and Elizabeth Kolbert. We will look to writers who approach nature from a range of cultural perspectives, including Black and Indigenous poets, the Black ornithologist J. Drew Lanham, and the Potawatomi biologist Robin Wall Kimmerer, widening our conception of who cares about nature and offering alternatives to the European-American investment in scientific mastery, extraction of resources, and industrial progress.

The range of readings relevant to the seminar's subject is vast, and the final choice of shared readings will be shaped by the subject matter and grade level of teachers participating in the seminar. A key text will certainly be Camille Dungy's anthology, *Black Nature: Four Centuries of African American Nature Poetry*. Other likely readings include Rachel Carson's *The Sense of Wonder*, Richard Prum's *The Evolution of Beauty*, Robin Wall Kimmerer's *Braiding Sweetgrass*, Louise Erdrich's *The Birchbark House*, Richard Powers' *Bewilderment*, and N. Scott Momaday's *Earth Keeper*. The subject matter of the seminar is interdisciplinary, and contributions of teachers of STEM subjects would be invaluable if the study of writing about nature will enhance their teaching and their curriculum plans.

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Transitions in the Conception of Number: From Whole Numbers to Rational Numbers to Algebra

Roger E. Howe, William R. Kenan, Jr. Professor Emeritus of Mathematics

Although it is not the whole curriculum, the study of number is the key topic in mathematics from kindergarten into high school. An underappreciated fact, however, is that as students progress through the grades, the nature of the numbers they are expected to use changes, and students need to think about numbers differently. Failure to appreciate the changes can lead to failure in mathematics. However, our standard curricula do not make clear the nature of the needed transitions, and this creates confusion in many students.

Roughly speaking, two main transitions are needed: from whole numbers to fractions, and from arithmetic to algebra. Very concisely, when students first meet numbers, they work with whole numbers, which are dealt with as counts. There are collections of discrete objects, often more or less identical, and you learn to find "how many" by counting. Obviously, thinking of numbers as counts does not help in dealing with fractions. Various descriptions of fractions may be given, but how they are related, and how they should be used to think about fractions is generally not discussed. The best way to think about fractions is as *ratios*: they tell you how large a given quantity is *in relation to a unit*

of the same kind. Unfortunately, the idea of "number" and the idea of "ratio" are not made synonymous in our curriculum. This is a problem that goes back to the Greeks, who, although highly accomplished in geometry, had a relatively primitive conception of number, which for them meant "whole number". It was left for Sir Isaac Newton, in his book "Arithmetica Universalis" to unite the two ideas. Newton wrote:

By Number we understand not so much a Multitude of Unities, as the abstracted Ratio of any Quantity, to another Quantity of the same Kind, which we take for Unity. [Number] is threefold; integer, fracted, and surd, to which last Unity is incommensurable.

But teachers can not simply tell students "a fraction is a ratio" and expect them to think appropriately. There needs to be a lot of work with, and emphasis on, units. There are several models that can be useful in promoting this kind of thinking, including length models and area models. Some ways of using both these types of models will be an important part of the seminar.

As students master arithmetic, and begin to study algebra, their conception of number again needs to change. The transition is marked by the increasing use of symbols. (Here again, the thinking leading to symbolic algebra is relatively new. Although "algebra" problems had been solved since ancient times, symbolic algebra was only created around 1600, primarily by Francois Viete, only about two generations before Newton.) Use of symbols points to the needed transition in thinking: instead of dealing with numbers individually, students need to think of them as members of a system defined by properties. The properties are the *Rules of Arithmetic* (aka *Properties of the Operations*). The point that needs to be absorbed is, that the Rules, which have probably been mentioned well in advance of the study of algebra, are now *the Rules*.

Together with the principles of equality, and the grammar of expressions, they tell you what computations are legitimate, and how various computations are related to each other. Study of the grammar of expressions starts early, and should be considered pre- or early algebra. It needs careful, explicit attention. Absorbing the formal structure imposed by the Rules, along with the grammar of expressions, and how they guide you in symbolic manipulation, should help students master algebra.

This seminar will discuss the thinking involved in the two critical transitions described above, as well as appropriate preparation and possible teaching moves to get students to successfully make the needed changes. It should be useful for teachers at all grade levels, either to prepare for the transitions, or to gauge whether a student has made the changes needed, and if not, what might help bring them up to speed.

Environmental Justice

Jordan Peccia, Thomas E. Golden, Jr. Professor of Environmental Engineering

Human exposures to pollution and other environmental risks are unequally distributed by race and class. This seminar will consider the evidence for, and consequences of, environmental injustices. We will also examine how current and historical policies have allowed for these inequalities, and study environmental justice examples in air quality, water pollution, solid waste management, and climate change.

Robust solutions to environmental problems must incorporate knowledge from the natural sciences and humanities. Thus, this seminar is well suited for junior high and high school teachers who teach a breadth of topics. It is my hope that by learning about current and past environmental injustices, teachers and students will gain a broader and more inclusive perspective on how to better solve environmental problems that impact human populations.

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Nature-Inspired Solutions to Disease Problems

Paul E. Turner, Rachel Carson Professor of Ecology and Evolutionary Biology

Why does a submarine look like a whale? Because humans have long turned to Nature for solutions, such as how to design a boat that travels underwater. Similarly, we have looked to species biodiversity as inspirations for solving disease problems. Since prehistoric times, humans have experimented with curing illnesses by harnessing species – especially plants – found in natural environments. Modern approaches are being used to determine how and when these 'folk' or traditional medicine approaches are valuable for solving disease problems. In the current day, we continue to be inspired by the Earth's biodiversity to address health concerns, including uses of viruses and other microbes to cure diseases that are resistant to antibiotics. Similarly, roughly 50% of anticancer drugs are derived from natural products, or inspired by knowledge of them. As we grapple with concerns over pests that threaten the agricultural food supply, and the ongoing threats of emerging pathogens that can spur pandemics, we are continuously searching for Nature to inspire solutions. Meanwhile, we must be careful to debunk myths about medicinal properties of endangered plants and animals, which can place these species at the brink of extinction. This seminar explores the many ways that humans have looked to Nature for solutions to disease problems, ranging from prehistoric efforts to more recent traditional and modern approaches, emphasizing the importance of understanding and preserving biodiversity as a means to solve human problems.

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