

Contents

Plastics: An Introduction Caroline Fowler	1
Conservation and Plastics Anne Gunnison	17
Plastic Histories of Art David Joselit	37
Case Studies in Plastics	
The Conservation Treatment of a Naum Gabo Elena Torok	75
Hide, Feathers, Beads, and Plastics: The Continuum of Care at the National Museum of the American Indian Susan Heald and Kelly McHugh	89
Plastic Disability Things: Jake's Ankle-Foot Orthoses and the Materials of Disability Bess Williamson	103
Detecting Particle Ecologies on a Plasticized Planet Jennifer Gabrys	117
Plastic Only: Plastics in the Artist's Studio Kevin Beasley	129
Notes	137
Further Reading	139
Contributors	145
Index	146
Photography and Copyright Credits	151

Plastics: An Introduction

Caroline Fowler

There are infinite origin stories for plastics. Although plastics might be considered a material of the twentieth and twenty-first centuries, they are made from fossil fuels, and therefore are drawn from the deep geological time of the earth. Plastics also might be conceived of as the embodiment of artificiality, chemical formulas derived from human ingenuity, spawning materials unknown in nature. Yet they were developed in relationship to nature, as imitations of natural materials. Any number of the origin stories for plastics describe a process by which a biobased material—ivory, resin, or shellac—could not be extracted, harvested, and hunted to the degree necessary to support the emergence of capitalist consumer cultures. Therefore, the world of plastics was born as scientists sought to engineer forms that could replace the rarer, more expensive materials. But the capacity of plastics to be absorbed into the natural world—like other biobased stuff—has proved catastrophic, and many of the chapters in this volume engage with the impact of plastics on the environment and earth today.

Yet while we might conceive of plastics as solely synthetic polymers that degrade in ways that are harmful, it is necessary to understand their history in relationship to the biobased substances that they were often meant to imitate. Natural rubber—one of the iconic materials that plastics have sought to imitate—derives from trees [FIG. 1]. It was sacred to the Maya and also mixed in varying proportions with other plant matter to create various forms of rubber—from armor and sandals to rubber balls. As one historian notes, the first “polymer scientists” were the Maya. From his second voyage to the Americas, Christopher Columbus brought a rubber ball to Europe, and many of the early chroniclers of these first encounters described the qualities of rubber. Peter Martyr, who wrote a popular account of the Americas based on Columbus’s travels known as *De Orbe Novo* (1555), wondered at how “with only a touch they [rubber balls] reach the stars with an incredible jump.” Later in the eighteenth



[FIG. 1]
Anonymous, *Rubber Tree*
in Florida, 1891–1909.
Stereography, albumen
print on cardboard,
3.5 × 7 in. (88 × 178 mm).
Rijksmuseum, Amsterdam.

century, Europeans encountered Amazonian people who employed rubber to make water-resistant clothing—such as rubber boots and hats. Seedlings of rubber trees from the Brazilian Amazon were carried into Asia, transmigrating an economy in rubber from Brazil to Asia and creating rubber tree plantations around the world from Brazil to Calcutta and what is today the Democratic Republic of Congo, where rubber and latex were harvested through enslaved labor. Despite the plantations of rubber trees, though, the production was not sufficient to meet the demands of communication technology when the first transatlantic cable was built in the early twentieth century, increasing the need for synthetic rubbers, which would lead to the revolution in elastomers.

Notwithstanding the production of synthetic rubber, plantations of rubber trees still exist today. Artist Eddie Aparicio traveled to a rubber tree plantation in Guatemala to make a cast of a rubber tree, noting that the air was infused with the ammonia while the toxic fumes were inhaled by Indigenous and migrant workers [FIG. 2]. Latex, the milky juice from a rubber tree, is collected in cups by slashing the tree diagonally. To prevent coagulation, ammonia is added to the containers to keep the latex fluid “running” before further processing. Aparicio’s rubber tree casts formally recall other works that will be discussed in this introduction—such as Eva Hesse’s innovations in the world of polymers. In turn, they also capture the tension between the natural world and the synthetic, the ingestion of chemical fumes and toxins through breathing while revealing the beautiful patterning of the tree bark on the surface of the natural latex. The natural and synthetic rubber industries exist in relationship to one another. The use value of natural rubbers stimulated the desire for inventing synthetic rubbers.

Beginning this short art history of plastics through the lens of rubber is only one origin story. Conservator Anne Gunnison begins her chapter in this volume with ivory and billiard balls at the turn of the twentieth century. There are also other places to start, such as shellac—originally used to make vinyl records. But starting with the cast imprint of the rubber tree demonstrates that, while plastics might be a relatively new invention, the creation and manipulation of natural materials to forge malleable and resistant surfaces is an age-old story. Moreover, Aparicio’s cast of the rubber tree demonstrates one role of plastics in our contemporary world, which is not only as a material that furthers environmental destruction but also as a material that is central to conservation, the archive, and carrying the imprints of the natural world—holding a record of a world that is rapidly changing under the conditions of climate change. Plastics, perhaps more than any other material, are directly about the relationship between art and nature, and the desire of humans to imitate, mimic, reflect, imprint, cast, understand, and exceed the limits

of the natural world as well as their place within it. There is no material more closely intertwined with the exploitation and extraction of natural resources and colonial histories of ecological destruction since 1492. Although the science of plastics began in the nineteenth century, its origin can be traced to the introduction of the rubber ball to Europe. This singular object embodies the stoking of a desire for materials that challenged the limits of the properties of nature—an ability to bounce to the stars—and the violent extraction of resources and knowledge necessary to achieve the production of commodities on a scale that would shift the ecological, economic, and cultural worlds of the modern eras.

As the conservators of the National Museum of the American Indian (NMAI) show in this volume, plastics derived from crude oil are intrinsic to the history of the Dakota Access Pipeline, a transportation network for oil that also infringes on the sacred grounds and threatens the water supply of the Standing Rock Sioux and Cheyenne River Sioux. This extraction of raw resources to support numerous industries (including plastics) is just one example of many in which the mining of resources impacts and imperils communities, and ignores the sovereign rights of Native Americans to control their land and resources—a history that started in the year 1492. Plastics, however, have also become integral to Native American and Indigenous arts, and conservators at the NMAI work to conserve plastics, and preserve the artistic legacy and knowledge of the many Indigenous cultures within the United States that now depend on plastics. Therefore, looking at plastics in relationship to art and conservation engages with one of their primary paradoxes for our contemporary world: they both play a role in our current environmental crises, and are a vital material for documenting, archiving, and preserving. They both threaten the environment and are vital to conservation.

Examining the history of plastic through the lens of art history and conservation, which is the goal of the ART/WORK series, poses a fundamental question: *What do we learn about plastics when seen through the lens of art?* How does creative practice and its intersection with the material qualities of plastics inform how we conceive of plastics as toxicity, waste, and disposable refuse while also supporting nearly every aspect of the modern world's infrastructure? This is a contradiction that nearly all the authors in this volume explore. In considering the material of plastics through the lens of art history and conservation, this volume addresses the particular challenge of plastics within the world of art, for plastics and the modern museum evolved together.

Many plastic artworks were constructed in relationship to the air-conditioned, temperate environment of the museum, which controls humidity, temperature, and light—conditions that allow plastics to remain stable within the walls of the museum. As Gunnison outlines in her



[FIG. 2]
Eddie Rodolfo Aparicio,
Pulmón #2, 2023. Cast
rubber with ficus tree
residue and air from Los
Angeles, San Salvador, and
Massachusetts. Clark Art
Institute, Williamstown, MA.

chapter, conservators and museums are dependent on plastics, from the use of adhesives in conservation to the role of plastics in creating cases, displays, and exhibition designs. Plastics were also central in building museum collections in the nineteenth and twentieth centuries, transporting artworks from distant places to European and North American collections. Gunnison discusses the use of adhesives in removing frescoes and wall paintings from distant locations to hang in European and American museums, such as the acquisition of the Dunhuang frescoes by the Harvard Art Museums in Cambridge, Massachusetts. The history of pillaging, removing, and displacing artworks across vast distances was made possible with the invention of plastics. Yet plastics also play a central role in conserving works of art for future generations.

Museums are built as repositories of knowledge and culture that will conserve objects across generations—and even perhaps millennia. But often museums themselves are ecologically unsustainable, requiring vast resources to maintain control over temperature and humidity as air-conditioned containers that depend extensively on the depletion of natural resources to preserve objects. Increasingly, many of the objects that these ecologically fraught institutions are preserving are plastics. There are many museums and initiatives working toward greater sustainability in the field of museums, and hopefully the ecology of museums will shift over the coming decades. Nevertheless, the conservation of objects and their preservation for the future often comes with a significant carbon cost, and the conservation of plastic objects is no exception. Many environmental and ecological studies of plastics focus on their inability to biodegrade while also releasing microplastics into waterways and systems, from the human body to the oceans. Art conservators, though, as demonstrated by the chapters of Gunnison and Elena Torok in this volume, work with plastics that are capable of rapid disintegration and, in some cases, combustion. While environmental scientists draw public attention to the life cycle of plastics, and their varying capacities for degrading and recycling to mitigate harm to the environment, museum conservators focus on preserving plastics for the future, particularly plastics that are unstable within museum collections.

Some of the most unstable plastic works within collections are the early twentieth-century sculptures by Naum Gabo and Antoine Pevsner, who found in plastic the ideal material to create sculpture devoid of line, volume, mass, and static form (and often color). Gabo and Pevsner sought to build sculptures that embodied a “kinetic rhythm” to capture the “perception of time.” Paradoxically, however, the earliest plastics that they incorporated into their sculptures began to rapidly deteriorate, frequently yellowing and quickly becoming brittle and hard, losing the bendable, light-filled dynamism of their initial production. Instead of producing

[FIG. 3]
Antoine Pevsner, *Portrait of Marcel Duchamp*, 1926. Cellulose nitrate on copper with iron, 25.75 × 37 in. (65.4 × 94 cm). Yale University Art Gallery, New Haven, CT. Gift of Collection Société Anonyme.



transparent sculptures devoid of line, forging constant perceptions of movement, the sculptures soon became defined by their yellowed surfaces and fragility. For example, the *Portrait of Marcel Duchamp* by Pevsner in the Yale University Art Gallery was mounted on copper after its initial mount was broken. As Torok discusses in her chapter, this new material caused a reaction with the cellulose nitrate of the plastic, triggering a rapid deterioration [FIG. 3]. The copper base quickly tarnished to a turquoise sea while the plastic became varying shades of amber. A viewer might imagine its original form: an overlapping geometry of translucent planes to create a portrait that captures the particular quality of faces to ceaselessly move and change in minute muscular shifts. The portrait has nonetheless deteriorated to a state of semifrozen brittle degradation that conveys the impact of time on materials. Pevsner and his frequent collaborator Gabo wanted to build sculptures in space that were studies in geometry, precision, and three-dimensional form, renouncing color and line as “an accidental trace of man on things.” Yet Pevsner’s portrait of Duchamp unintentionally embodies the “accidental trace of man on things” and inescapable ravages of time on matter. In some cases, as in Pevsner’s *Torso* in the MoMA collection, the work survives in fragments and has been declared “dead.” It will no longer be exhibited, although it remains in the collection for research and archival purposes. In her chapter in this volume, Torok explores the impact that the fragility of their works had on Pevsner and Gabo along with their legacy.

Other artists, however, conceived of the degradation of plastics and incorporated this into their fascination with the material. Hesse, whose first major solo exhibition was called *Chain Polymers* (1968), recognized the fragility of her works. As Hesse stated in an oft-cited interview from *Artforum* in 1970, “And then the rubber only lasts a short while. I am not sure where I stand on that. At this point I feel a little guilty when people want to buy it. I think they know but I want to write them a letter and say that it’s not going to last. . . . Life doesn’t last; art doesn’t last.” While her most iconic work from that exhibition, *Repetition Nineteen*, is now relatively stable in its current state, it has also achieved a patina of yellow infusing the fiberglass and resin [FIG. 4]. The yellowing was not intrinsic to their original appearance, but it further enhances the embodied qualities of contingency and imperfection that the installation suggests in the arrangement of the vessels scattered across the floor, bending toward and away from one another. Hesse’s diaries demonstrate that she attended a lecture series in New York City for artists, *Experiments in Art and Technology*, in which scientists from Bell Telephone Laboratories gave talks on topics such as “Polymers” and “Casting, Molding, and Control.” Her surviving notes on the lectures reveal that she was invested in the chemistry of polymer science. Whereas Pevsner did not intend for



[FIG. 4]
Eva Hesse, *Repetition
Nineteen III*, 1968. Fiber-
glass and polyester resin,
nineteen units, each 19
to 20.25 in. (48 to 51 cm)
and 11 to 12.75 in. (27.8 ×
32.2 cm) in diameter.
Museum of Modern Art,
New York.

his sculpture to morph and become brittle, Hesse embraced the shifting qualities of plastic materials. Nevertheless, both artists belong to a certain genealogy of artists whose careers and work were shaped by the particular qualities of plastic. For Pevsner, the material held possibilities for creating form devoid of line, color, and volume, while for Hesse her works consider the limits and beauty of bodies in the wake of the world wars, Holocaust, and postwar industrialization. In *Repetition Nineteen*, the vessels bend, turn, and lose their geometric perfection and clear transparency in favor of a slight deformation that allows for a reflection on as well as rejection of smooth impossible surfaces.

Still, although certain artists explicitly engaged with plastics as a material along with its limits, to write a short history of plastics in art is almost an impossible task, as David Joselit demonstrates in his chapter. Beyond artists such as Pevsner and Hesse who studied the material properties of plastics, polymers touch on almost every aspect of modern and contemporary artistic production. Acrylic paints are plastic. Film is fabricated from plastic. Most artists' materials today would be impossible without the plastics industry. While single-use plastics and the petrochemical industry are an emblem of the destructive force of human innovation and design, plastics are the surface and material that defined twentieth- and twenty-first-century artistic innovation too. Painting, sculpture, film, and photography—they are all mediums defined by plastics in the twentieth and twenty-first centuries. This is the complication with thinking about the specific materiality of plastics—their *plasticity* allows them to exist within a wide variety of matter—from paint to film to sheeting. This variety and variability make the specificity of plastic as a material nearly impossible to consider. Plastics touch every aspect of artistic production whether it is a painter working in acrylics, sculptor working with resin (as will be seen in this introduction), or photographer working with celluloid film. Plastics shift their specific quality across practically all media of modern and contemporary art.

Unlike bronze, marble, tempera, or even paper, plastics are too expansive a material to productively engage a specific material history. As artist Kevin Beasley shows in his chapter in this volume—which is an exploration of the plastic materials that structure the space of his studio—plastics are not only a material with which artists work but the atmosphere that we all breathe as well. In turn, in her chapter, Jennifer Gabrys discusses the atmospheric qualities of plastics and dangers they pose to inhalation. When the world is viewed through the lens of micro-plastics, plastics run through our systems and bodies, restructuring our biological forms. While artists have no doubt inhaled marble dust and paint fumes for centuries, there has never been such a full-scale alchemical transformation of the natural world through the micro- and

nanoworld of plastics. In this way, plastics are difficult to write about because they are atmospheric.

As any conservator of plastics, film, or archives know, there is a specific pungent smell of camphor or vinegar that hits one's nostrils and lungs when one encounters a plastic work that has begun to degrade. The smell when viewing a Pevsner sculpture within a conservation lab comes with an olfactory punch that makes evident how plastics infiltrate the air. This physical atmosphere of plastics is evoked in the work of Aparicio that started this introduction and his discussion of the ammonia in the air of the rubber tree plantations—chemicals meant to keep the natural latex flowing for further processing. There are also other contemporary projects that examine this consideration of “aspiration” that has derived from the rise of plantation economies.

Beasley's exhibition *A View of a Landscape*, which ran from December 15, 2018, through March 10, 2019, at the Whitney Museum, directly engaged with the atmosphere of environmental degradation and its impact on bodies. In this work, Beasley restored the motor of a cotton gin and installed it into a soundproof chamber [FIG. 5]. In the space of the gallery, the motor whirled within the chamber, although the gallery itself remained silent. In the adjacent room, Beasley remixed the sounds of the cotton gin motor to create music and ambience—space for living within and with the legacy of the plantation economy while transforming it into a new ontological possibility, transmuting the sounds of the cotton gin into music, ambience, and space that could interpenetrate into bodies within the aesthetic space of the museum. While Beasley's installation might seemingly only touch on the history of cotton in the United States, cotton is central to the history of plastics and film too. In the nineteenth century, it was discovered that treating cotton cellulose with an acid mixture (various acids and combinations of alcohol, ether, and camphor, among other “plasticizers”) created a liquid that formed into a transparent sheet ultimately known as celluloid. Yet the earliest forms of celluloid were extremely dangerous, often derived from “gun cotton,” or a military-grade gunpowder. Gunnison discusses this history further in her chapter, but one of the most important and influential archival surfaces of the twentieth century—cellulose nitrate film—is flammable and combustible, capable of burning without oxygen. It is also a surface intrinsic to the history of the cotton plantation economy.

Yet in the work of Beasley, plastics often appear to archive for the future. Beasley sometimes uses polyurethane resin to “fossilize” cotton surfaces and materials, endowing a veneer of survival beyond the lifespan of the garments. Whereas textiles are famously sensitive to conditions of light and temperature (particularly in humid climates such as the US South), Beasley employs plastics to preserve these garments and



[FIG. 5]

Kevin Beasley, *A view of a landscape: A cotton gin motor* (detail), 2012–18.

Chamber: GE induction motor, custom soundproof glass chamber, anechoic foam, steel wire, monofilament, cardioid condenser, microphones, contact microphones, microphone stands, microphone cables, AD/DA interface. Listening Room: Custom speaker system, subwoofers, amplifiers, AD/DA interface, ethernet switch, mixer, modular synthesizer, equipment racks, wood table. Vitrine: 96 × 120 × 96 in. (243.8 × 304.8 × 243.8 cm).

other materials that might otherwise degrade and disappear [FIG. 6]. In preserving cotton, Beasley demonstrates that conservation is also central to the history of plastics, which meets the instinctual human impulse to archive for the future, so that the impression that we have left on this world does not disappear. Nevertheless, this desire has pushed the world to an unsustainable extreme so that the world itself, or at the very least our place within it, has appeared increasingly acutely finite.

Today, the history of plastics is inseparable from the history of this earth. In his discussion of plastics in his artist's studio, Beasley makes evident the integral role of plastics in both daily life and artistic practice while acknowledging how they infect the air that we breathe. Artists and conservators take a particular vantage point in trying to understand this material—frequently aware of the environmental problems posed by plastic but also invested in its design, its possibilities, and the ways in which it reflects like no other material the complexity of history after 1492. From the perspective of art history, plasticity as a concept defines modern and contemporary artistic production, although as Zakiyyah Iman Jackson shows in *Becoming Human: Matter and Meaning in an Antiblack World*, plasticity is also an “anti-Black mode” that puts a demand on Blackness and Black bodies to be “infinitely mutable,” particularly in regard to sex, gender, and reproduction. Moreover, the plasticity assigned to the human body is a construct that Bess Williamson explores in her chapter, considering how the world of plastic prosthetics can force bodies into idealized images of what it means to walk, sit, eat, and exist—again, considering the conceptual world of plasticity as a violence that is often enforced from without. Still, as Williamson argues, plastic's malleability, disposability, and accessibility sustain modes of living for people with disabilities, or certain chronic conditions. Like many of the chapters in this volume, Williamson considers both the ontological violence of plasticity as a concept and the material of plastics overall, demanding recognition for the necessity of the world that plastics make possible. As Williamson points out, banning certain plastic materials—such as straws—distracts from the larger structural problems that threaten both the environment and communities most at risk of environmental catastrophe.

Williamson's chapter touches on one of the most important histories of plastics too—namely, their centrality to twentieth-century design and modernism. As Jason Weems contends, Charles and Ray Eames were innovative during World War II in creating biomorphic furniture with swelling curvatures to mold to the human body and making leg splints for soldiers. This fascination with molding form to the human body would ultimately impact their furniture design and such iconic forms as the Eames chair, a piece of furniture that contours itself to the human body. But as art historian Kristina Wilson asserts, midcentury design and



[FIG. 6]

Kevin Beasley, *The Road*, 2019. Polyurethane resin, raw Virginia cotton, Virginia soil, Virginia twigs, Virginia pine needles, housedresses, kaftans, T-shirts, du-rags, altered housedresses, altered kaftans, altered T-shirts, altered garments, altered tires, scarf, guinea fowl feathers, down feathers, copper, jewelry, shoelaces, mobile phone, burlap satchel, windshield wipers, altered African fabrics, socks, Timberland boots, aluminium, and steel, 96 × 120 × 10 in. (243.8 × 304.8 × 25.4 cm). Whitney Museum of American Art, New York.

objects (made possible through plastics) frequently construed their forms in relationship to an “ideal” body. Midcentury design too often assumes the contours of a thin, able (and usually racialized-as-white) body that can slip into the cocoon of its lines and hollow spaces. The bodies that do not fit within that model are left to shift, spill over, hunch, slump, and exist in perpetual discomfort.

ART/WORK as a series is meant to make histories of conservation legible to nonspecialists while also engaging in the various ways in which writing about art history and methods is informed by knowledge of the properties of a specific material. Plastic, in particular, poses important challenges and promises to this premise. Gunnison shows that despite the typically held view that plastics have long shelf lives and cannot decompose, there are unstable categories of plastics. Within the case studies, Torok introduces the handling of a canonical piece of twentieth-century plastic sculpture from the view of a plastic conservator while the conservators from the NMAI discuss handling the presence of plastics within their collections. Exploring contradictory aspects of plastics, Williamson explains the centrality of plastic as a material to design history and disability studies. Finally, Gabrys illustrates how plastics exist in the very air that we breathe, while Beasley, an artist dedicated to questions of aspiration, breath, and materials (such as cotton and plastic), walks the reader through his studio.

Like all the volumes in this series, this is not a comprehensive history of plastics. It is an introduction to thinking about plastics in art history. Returning to the fascination with the rubber ball, plastics and plasticity are harmful when they presume that the earth, our resources, our bodies, and all species are infinitely malleable, reproducible, and capable of defying the limits of gravity and space. The production of plastics supported a vision of a world in which natural resources could be created if they became scarce, and we could build materials that would not age, tear, or be destroyed. It is not so much plastics themselves that have been destructive but rather the fantasy that they have generated. Yet as art conservators recognize, plastics are limited, and they are also central to the act of conservation itself in the twenty-first century. The material qualities of plastics explored in this volume are by thinkers who consider what it means to fossilize and preserve our plastic world for an uncertain future, recognizing that whatever happens, it is clear that our present will be seen in the future through plastic and its refuse.

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.

Conservation and Plastics

Anne Gunnison

In 1878, the Celluloid Piano Key Company published the musical score *Celluloid Grand March Op. 4* for the pianoforte, composed by Charles Wels, who is listed as the company's vice president [FIG. 7]. The score is not so much concerned with compositional innovation but rather material invention, as the last few pages are an advertisement for a new material, celluloid ivory, marketed as a replacement for elephant ivory for piano keys, organs, and melodeons. There are testimonials from organ and piano company proprietors who extol the virtues of the celluloid keys. In bold, the ad claims, "In fact, under every condition and circumstance, for Piano, Organ, and Melodeon Keys, the Celluloid Ivory is better than Elephant Ivory, and is speedily and surely supplanting it." And so the great march of the plastics begins.

Celluloid ivory is cellulose nitrate, a semisynthetic plastic, developed and patented in England by Alexander Parkes in 1865. His attempt to take this market under the name of Parkesine failed by 1868. Parkes's US counterpart, John Wesley Hyatt, was simultaneously seeking to discover an alternative for elephant ivory, which was used to make billiard balls. Ivory was scarce and expensive, and Hyatt's endeavor was made more appealing by the promise of a \$10,000 reward by the billiards company Phelan & Collender to anyone who developed a replacement for ivory. Hyatt was successful in both developing cellulose nitrate as a material and making it commercially viable. By 1868, Hyatt's Albany Billiard Company was in business. By 1870, Hyatt and his brother had established the Celluloid Manufacturing Company in Newark, New Jersey. Beyond billiard balls, celluloid, the name Hyatt trademarked in 1871, was used primarily as an imitative material for more expensive and rare materials (ivory, tortoiseshell, and horn), to manufacture shirt collars and cuffs, hair combs, and home goods.

By 1968, one hundred years after the founding of the Albany Billiard Company, plastics had become something completely different and

yet wholly the same. The formulas and chemical compositions were different and greatly expanded, but the principle of plastic as a malleable replacement for something natural was familiar. *Motor Trend's* car of the year in 1968 was the General Motors Pontiac GTO, the first year it was outfitted with the Endura bumper. Instead of a metal bumper, which had graced the front of cars since auto manufacturer Henry Ford's early models, the Endura bumper was made of high-density urethane elastomer—that is, a plastic. Ford himself had developed a plastic car in 1940, though the bumpers were still in fact metal. (And only one of Ford's plastic cars was ever made.) In a television advertisement for the GTO—as perhaps a nod to Ford's own demonstration of hitting his plastic car with an ax, causing no damage—an actor in a white tuxedo approaches the GTO with a crowbar and repeatedly hits the front bumper, causing no dents or cracks. After throwing the crowbar to the ground, the actor declares, “This is a brand new 1968 Pontiac GTO. It has a new bumper. It's the most revolutionary new bumper, since . . . bumpers. Seems like everything those Pontiac engineers touch turns to great.” In another version, a team of engineers, white men in white lab coats, takes turns trying to smash the bumper with a crowbar while the engineers' colleagues frantically and aggressively yell encouragement. They are unsuccessful. It does not smash, crack, or break. Nevertheless, although the bumper may survive a fender bender, it could not survive the ravages of the elements. The bumper was known to crack and fade, especially in hotter climates, and Pontiac had to release a repair kit.

That same year, 1968, the movie *The Graduate* was released. In a now-iconic early scene, recent college graduate Benjamin Braddock, played by Dustin Hoffman, is pressed about his future career and cornered by a Mr. McGuire, who has some advice:

Mr. McGuire: I want to say one word to you. Just one word.

Benjamin: Yes, sir.

Mr. McGuire: Are you listening?

Benjamin: Yes sir, I am.

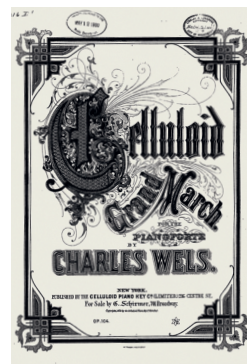
Mr. McGuire: Plastics.

Benjamin: Exactly how do you mean?

Mr. McGuire: There's a great future in plastics. Think about it.

Will you think about it?

For Braddock, plastics are banal and representative of a pretty bleak future for him and his generation. Plastic is both a material and a concept. In the case of *The Graduate*, the prospect of a career in plastics suggests the ennui of mainstream middle-class America that the contemporaneous counterculture in the United States sought to reject. This was



[FIG. 7]
Charles Wels (composer),
Celluloid Grand March, New
York, 1878. Celluloid piano
key. Library of Congress,
Washington, DC.

also the year that the Plastic People of the Universe (PPU), a Czech band, formed in Prague, two months after Soviet troops invaded Czechoslovakia on August 20, 1968. The arrest of PPU band members in 1976 partially influenced, at least in popular lore, the drafting of Charter 77, a petition written by Czechoslovakian writers and intellectuals, including future Czech Republic president Václav Havel, demanding the Communist Czechoslovakian government recognize basic human rights. PPU's name was inspired by the 1967 song "Plastic People" by Frank Zappa and the Mothers of Invention. Zappa's lyrics make it clear that plasticity is not something to aspire:

*Take a day and walk around
Watch the Nazis run your town

You think we're singing 'bout someone else
But you're plastic people
Oh baby, now you're such a drag

Me see a neon moon above
I searched for years, I found no love
I'm sure that love will never be
A product of plasticity*

In Zappa's lyrics, plasticity is indicative of something much more sinister than Braddock's depressive future. It is equated with fascism and those who are unquestioningly complicit with it, but the PPU took the concept of plastic people to represent the antiestablishment.

This duality is a defining characteristic of plastics: it can be both revolutionary and conformist. Plastic is a semantic monolith, representing a material that has been developed to be a physical and ideological chameleon. Plastics are endless permutations of distinct chemical reactions and formulas, all categorized as plastic. Plastics are duplicitous, as their very origin story is rooted in pretending to be something that they are not. Is plastic long-lasting, or does it degrade easily? Both. Is it organic or inorganic? Primarily derived from organic materials (petroleum and cellulose), plastics in general do not biodegrade or decompose like natural organic material but rather disintegrate into smaller and smaller pieces, which remain in themselves plastic. Plastics can be rigid or flexible, transparent or opaque. They can be a problem. They can be a solution. The over 150-year development of plastics from an alternative to ivory and tortoiseshell to a universally pernicious substance can be traced through patents, advertisements, scientific papers, the history of industrialism and colonialism, environmental reports, design trends, and popular culture in a way that is seemingly incomparable in scope with any other

material. And this is reflected in objects of cultural heritage, which have been acquired by museums as historical objects, artwork, design objects, scientific specimens, and more.

Though plasticity and plastic are concepts, plastics are also very much a specific material, from hair combs to reels of film to monumental sculpture. The materiality of plastic in an object cannot be ignored when understanding the concept of the object. Plastics can be some of the most stable objects in a museum collection but equally the most fragile and prone to severe degradation. Conservators' decisions and hands-on technical skills aim to preserve as well as care for tangible history and art objects. To make decisions about the appropriate methods of preservation of this cultural property, a conservator must have a basic understanding of the materials. Plastics, however, come into the museum as so many formulas, shapes, properties, and manufacturing histories that identification and understanding can be difficult. They can be commercial products with proprietary recipes. Some plastics were marketed under specific names, which can both reveal and obfuscate their type as well as function. It is no wonder that this material is aggregated into a common term: plastic.

The Fourth Kingdom

To be a conservator, tasked with studying and preserving cultural heritage objects, is to be constantly playing a game of twenty questions: What is this object? Where did it come from? Who made it? What is it made of? How was it made? And to be a conservator in a museum that has collected objects from the past 150 years is to face the conundrum of plastic. Plastic? Animal, vegetable, or mineral kingdom? Or is it its own kingdom all together? The so-called fourth kingdom is a notion introduced in a marketing movie filmed in 1937 by the Bakelite Corporation, a plastics company: "Our modern complex industrial world has turned elsewhere to fulfill its needs. Turned to a fourth kingdom. A kingdom of scientific research, a new domain of man's own creation. A world of primary substances which never existed before."

The materials in this fourth kingdom are hard to comprehend because plastic, a name that can encompass so much, is a product of a complex industrial process, and it can be difficult to determine just what it is. It is often easier to simply describe it as plastic.

What Are Plastics?

They start small. Monomers are molecules that are bonded to other identical molecules. During the polymerization process, monomers react together to form polymers. Polymers are chemical compounds that are long repeating chains of molecules. Plastics are polymers, though not all polymers are plastic. While this discussion is primarily focusing

on plastics as manufactured or synthetic substances, there are natural polymers. These include bitumen (a tar that is the thickest form of petroleum), shellac (secretions of a lac bug), gutta percha (a latex from the *Palaquium gutta* tree), rubber (from *Hevea brasiliensis* trees or *Landolphia* vines), and cellulose (plant matter) as well as horn and tortoiseshell (keratin).

Semisynthetic polymers are made when a natural polymer like cellulose is chemically reacted with an organic compound. An example is cellulose nitrate, formed when cellulose fibers are treated with a solution of nitric acid. Hydroxyl groups on the cellulose are replaced with nitrate groups. In the case of John Wesley Hyatt's celluloid, the addition of a solvent and camphor, a white crystalline solid extracted from a camphor tree, to the nitrated cellulose prevented significant shrinkage while drying.

Synthetic polymers are those that are derived from petroleum, natural gas, or coal, though there are biobased polymers, for which a percentage of the monomers are from natural materials like corn or starch. The first truly synthetic plastic, phenolic resin, converted from phenol (a coal product) formaldehyde, was discovered in 1907 by Leo Hendrik Baekeland. He lent his name to this plastic, which was called Bakelite. Just as cellulose nitrate was used as a replacement for other natural polymers and materials, phenolic resin was developed as a replacement for shellac (often used for music records). But even in Bakelite's infancy, Baekeland recognized it as a material that could have many applications. Synthetic plastics are further broadly categorized as thermoplastic or thermoset. **Thermoplastics**, because of their polymer structure, are able to be remelted and reformed. **Thermosets**, because their polymer chains cross-link on setting, can only be heated and formed once. Museum objects can represent natural, semisynthetic, and synthetic plastics. Most plastic objects made after the 1920s will be synthetic plastics, however, representing an incredible range of plastic families: polyolefin, vinyl, acrylic, styrenic, polycarbonate, phenolic, and epoxy, to name a few. And most of these will have been derived from petroleum processing.

Natural gas and crude oil are mixtures of hydrocarbons. These hydrocarbons are organic compounds of hydrogen and carbon molecules derived from decomposed plant as well as animal life from hundreds of millions of years ago that have undergone heat and compression through geological time. After sources of natural gas or crude oil are drilled and pumped, the raw material is refined, and the mixture of hydrocarbons that comprise the gas or oil are separated into groups. Two of these types of hydrocarbons are **naphtha**, which contains ethane and propene (also called propylene) and is derived from crude oil, and **ethane**, primarily derived from natural gas. Ethane and propene are heated to a high temperature in a processing plant called a cracker. This name comes

from the function of the plant: to crack the molecules of the hydrocarbons under high temperature, turning them into the monomers ethylene or propylene. These monomers are then polymerized with different types of chemical catalysts to engineer synthetic polymers with varying properties including polyethylene, polyester, polypropylene, polyamide, polystyrene, and polyvinyl chloride, among many others. The long chain polymers serve as the backbone of the product and additional characteristics are introduced to the polymer through additives. These can include antiaging through heat stabilizers, ultraviolet (UV) absorbers, and antioxidants; antistatic, blowing, and cross-linking agents; colorants; fillers; fiber; flame retardants; lubricants; and plasticizers. Plastics therefore represent endless permutations and recipes.

After polymerization, plastics can take the form of small pellets (< five millimeters) called preproduction plastic pellets, or colloquially, nurdles. These pellets are then used to manufacture countless plastic products through extrusion, melting, and molding. While these polymers are “organic” in that they have a carbon backbone, they are unable to be broken down readily in the environment because they are long chain polymers containing thousands of monomers, hence their strength. Currently, the most dominant and inexpensive types of polymers that are produced globally are polyethylene and polypropylene, because they are easily sourced from natural gas, resistant to degradation by water, air, or solvents, and easy to shape into a variety of objects, though mainly they are used for packaging. Given that the history of the development of synthetic plastics is well-documented, plastics can be used as a dating tool for objects. If the date of manufacture is known, the type of plastics may be identified based on the plastics available at the time or by its physical characteristics. Or sometimes it is as easy as looking at the symbols and/or brand names on a plastic object to identify the type.

In 1988, the Society of the Plastics Industry Inc., founded in the United States in 1937 in response to a growing number of recycling programs, developed a consistent code called the Resin Identification Code that identifies the plastic resins contained in products. In 2008, the administration of this coding system was turned over to the American Society for Testing and Materials International, an international standards company, which has developed the continually updated Standard Practice for Coding Plastic Manufactured Articles for Resin Identification. The numbers 1 through 7 on products, usually shown in a triangular recycling symbol (previously composed of three arrows, but now an equilateral triangle), identify the following: (1) polyethylene terephthalate (PET) bottles, cups, and other packaging; (2) high-density polyethylene bottles, cups, milk jugs, and so on; (3) PVC (or vinyl) pipes, siding, flooring, and so forth; (4) low-density polyethylene plastic bags, six-pack rings,

and tubing; (5) polypropylene auto parts, industrial fibers, and food containers; (6) polystyrene utensils, Styrofoam, and so on; and (7) others, including materials made with more than one resin from categories 1–6 as well as acrylic, nylon, polycarbonate, and polylactic acid. The number also indicates the relative ease and cost of recycling the material, with 1 being the most readily recyclable and 7 the most difficult.

Plastics as Museum Objects

It is difficult to determine, historically, when plastic objects first entered museum collections. And it would be impossible to itemize the types of objects made from semisynthetic and synthetic polymers that enter collections: cups, computers, paintings, cigarette holders, beads, clothing, chairs, sculptures, packaging, printed posters, and toys. For a conservator, it is easiest to think of how and why plastics are acquired, and at what point in the lifetime of the material, in relation to its manufacturing and use history, it enters the museum. This life cycle roughly follows the steps below:

1. Raw material acquisition: oil, natural gas, or biomass production
2. Material processing: creation of monomers and reagents for polymerization, and subsequent polymerization and compounding to create bulk plastic materials
3. Manufacturing and assembling: molding, extruded or other conversion of bulk plastic compounds, and any secondary products
4. Use life: the employment of the plastic product by the consumer, handling the product, and the effects of use on the plastic
5. End of life: the recycling or reuse of the product/material before it is disposed
6. Disposal: the final resting place of the plastic product, such as a landfill, incineration, or compost bin

Museums would not acquire plastics in the stages of raw material acquisition—as oil or natural gas. Yet the later stages of production have been archived by certain museums. In Sydney, at the Technological Museum (now the Powerhouse Museum, a branch of the Museum of Applied Arts & Sciences), for example, Arthur de Ramon Penfold, a former industrial chemist who worked as curator and later director of the museum, began in the 1930s to acquire specimens of plastic raw materials and finished products to illustrate the development of synthetic plastics. He requested samples from manufacturers and acquired objects that would represent this burgeoning fast-growing field. In 1934, the Sydney Technical College and the museum displayed the first Plastics Industry Exhibition in Australia. Following the success of this exhibition,

a permanent display of plastics was established at the museum, described by the *Sunday Telegraph* as “the best display of plastics and fibres in the world show(ing) the complete history of plastics from first experiments to the latest developments.”

In some cases, plastics enter the collection as modified forms of new plastics that have never had a use life as their production intended. For instance, Canadian artist Brian Jungen [see Heald and McHugh, this volume] purchases new plastics such as suitcases, chairs, Nike sneakers, and synthetic basketball jerseys, and then manipulates these objects to create artworks. The plastic objects from which these finished sculptures originated have never been used as intended, and their use life becomes defined by their manipulation in the artist’s studio.

In other cases, plastics that have gone through the complete life cycle, from raw material acquisition to disposal, are then salvaged for another use life. This is seen in the work of contemporary US artist Duke Riley [FIG. 8]. He uses plastics that have been expended and discarded. Riley removes them from the disposal process and creates works of art. In mirroring the history of plastics—as a material invented to replace valuable animal products such as horn, ivory, and tortoiseshell—Riley replicates scrimshaw, ink drawings etched into ivory, including walrus tusks and whale teeth, an artwork primarily made by whalers and seafarers in the nineteenth century. But instead of using these endangered materials, Riley replaces the tusks and teeth with discarded plastics—detergent bottles, toothbrushes, and other waste he has collected on beaches—to etch ink drawings onto their plastic surface.

In other capacities, there are museum objects that are not readily thought of as plastics, including motion picture film and synthetic painting media, semisynthetic and synthetic polymers, which must be taken into account as such. Motion pictures are primarily thought of as what is projected onto a screen. Yet this projection is only possible because of the composition of film, which was initially made from cellulose nitrate (from which derives the term *celluloid* for motion picture film) but was gradually replaced by cellulose acetate and now is primarily PET. Synthetic paints were developed to overcome some of the limitations of oil paints, organic binders, and natural resin coatings and varnishes. Starting in the 1920s, fast-drying cellulose nitrate lacquer, which could be sprayed and not brushed on, began to be used in the automobile industry to replace slow-drying oil resin paints. These paints were used by artists too, including in the 1930s by Mexican muralists like David Alfaro Siqueiros, who took advantage of the ability to spray these lacquers to paint larger surfaces [FIG. 9].

Alkyd paints, also introduced in the 1920s, were polymerized polyester with fatty acids. Though drying more slowly than cellulose-nitrate-based



[FIG. 8]
Duke Riley, No. 363 of the
Poly S. Tyrene Memorial
Maritime Museum, 2023.
Painted salvaged plastic, ink,
and wax, 25 × 4 × 0.25 in.
(63.5 × 10.2 × 0.6 cm). Duke
Riley Studio, Brooklyn, NY.



[FIG. 9]
David Alfaro Siqueiros,
Cosmos and Disaster,
1936. Lacquer, pyroxylin
sand, and wood on copper
mesh over plywood, 23.9 ×
29.9 in. (608 × 761 mm).
Tate, London.

Index

Note: Page numbers in italic type indicate illustrations.

ABS. *See* acrylonitrile butadiene styrene

Abstract Painting and Sculpture in America (exhibition, New York, 1951), 86

acetate. *See* cellulose acetate

acrylic, 23

acrylic paints, 10, 27, 38, 134

acrylic polymer emulsions, 27

acrylic resin paints, 27

acrylonitrile butadiene styrene

(ABS), 94, 100

adhesives, 6, 32–33, 35, 80–82, 84

Aeschlimann, Mischa, 126

aesthetics/art history, plastics and, 37–39, 41–65, 70

AFO. *See* ankle-foot orthotic

African art and culture, 49, 51

Albany Billiard Company, 17

Alexander Calder, Mobiles—Naum Gabo, Kinetic Construction and Constructions in Space (exhibition, Hartford, Connecticut, 1953), 82

alkyd paints, 24, 27

Alliance for the Chesapeake Bay, 117

American Society for Testing and Materials International, 22

Amerman, Marcus, 96–97

ammonia, 3, 11

animal glues, 32–33

ankle-foot orthotic (AFO), 103–7, 105, 111, 114–15

Anthropocene, 39, 40, 60, 112, 117, 119, 124, 127

Anyaeji, Ifeoma, 68, 70; *Ghangha O ha mmili* (*Ghanga the rainmaker*), 69, 70

Aparicio, Eddie Rodolfo, *Pulmón #2*, 3, 5, 11

archaeology, 58, 60

archival concerns with/uses of plastics. *See* conservation and archival concerns with/uses of plastics

Arman, 58, 60; *Jim Dine's Poubelle*, 58; *Poubelle Organique*, 58; *Trash Mash No. 1*, 58, 59

Artforum (magazine), 8

Arthur, Courtney D., 118

Art21, 98

automobile bumpers, 18

bacteria, 55

Baekeland, Leo Hendrik, 21, 91

Bakelite, 21, 32, 91

Bakelite Corporation, 20

Ballets Russes, 31

Barthes, Roland, 41–42, 103, 123

Beasley, Kevin, 11, 13; *The Blues* (*Delta*), 134, 135; in his studio, 131; *The Road*, 13, 14; *Untitled*, 130; *A View of a Landscape: A Cotton Gin Motor*, 11, 12

Bell Telephone Laboratories, 8

Belontz, Sara, 128

Benglis, Lynda, 55, 58; *Blatt*, 56–57

Bergmann, Melanie, 126

Biennale of Sydney, 98

Big Chief condoms, 94

Bigger, Stanford, *Laocoön* (*Fatal Bert*), 31

biodegradability, 6

bitumen, 21

Bocour, Leonard, 27

body: microplastics in, 123–24; plasticity of, 13, 49; plastic products for, 13, 15, 103–15; as subject of art using plastic materials, 54–55, 58

Boetzkes, Amanda, 61

Bonner, Matt, *Trump Baby*, 31

Borden Company, 32

BP (company), 66, 68

Bradfield, Elizabeth, “Plastic: A Personal History,” 35

bread dough, 55

British Museum, London, England, 33

Broodthaers, Marcel, 39; *Industrial Poems*, 43, 45, 47, 49; *Musée d'Art Moderne, Département des Aigles*, 43, 44; *Pense-Bête*, 43; *Telephone* (*Téléphone*), 43, 45, 46, 47

Brooklyn Museum of Art, New York, 31

Buchloh, Benjamin H.D., 45

Byron, George Gordon, Lord, orthopedic boot of, 108, 109

camphor, 11, 21, 27–28

Campt, Tina, 49

Carlton, James T., 39

Cascade Prosthetics and Orthotics, child's orthotic ankle brace, 103–4, 105

Cascorez, 32

Casein Company of America, 32

celluloid, 10, 11, 17, 21, 24

celluloid ivory, 17

Celluloid Manufacturing Company, 17

Celluloid Piano Key Company, 17

cellulose, 21, 32, 75–76, 85

cellulose acetate, 24, 27, 28, 31, 33, 78–79, 92, 94

cellulose lacquer, 33

cellulose nitrate, 17, 21, 24, 27–28, 31, 32, 33, 79, 87

cellulose nitrate lacquer, 24, 27
cellulose triacetate, 28

Chaat-Smith, Paul, 98

Charter 77, 19

Cheyenne River Sioux, 4

choice and consent, 104, 114–15

Choi Jeong Hwa, 61, 65

- Circle of Dance* (exhibition, Washington, DC, 2012), 94
 Clapp, Jennifer, 66
 coal, 21
 Cochiti, 92
 Cohen & Powell, 82
 collodion, 27
 Columbus, Christopher, 1
 conceptual art, 43
 conservation and archival concerns
 with/uses of plastics, 3–4, 13, 20;
 adhesives, 32–33, 35; benefits of
 plastic, 32–33, 35; celluloid for,
 11; and Gabo's *Constructed Head*
 No. 2, 78–87; museums and, 4, 6,
 23–35; at NMAI, 92–102; plastic
 museum objects, 23–27; problems
 in, 27–28, 31–32; resin for, 11
 constructivism, 52, 76
Constructivistes Russes: Gabo et
Pevsner (exhibition, Paris, 1924),
 78
 Corcoran, Patricia, 60, 124, 125
 cotton, 11, 13, 132
 cotton gins, 11, 12
 COVID pandemic, 92
 cracker (processing plant), 21–22
- Dakota Access Pipeline, 4
 Dallas Museum of Art (DMA), Texas,
 76, 78–82, 84–85
 Damasio, Antonio, 42
 dark plastic, 123
 dating of objects, 22
 Davis, Heather, 70
 DEHP. *See* di-ethylhexyl phthalate
 Dey, Tridibesh, 127
 dialectics, and the aesthetics/art
 history of plastics, 42–43, 45, 49,
 51–65, 70
 di-ethylhexyl phthalate (DEHP), 97
 Diné (Navajo), 92
 Dine, Jim, 58
 disability: and choice/consent, 104,
 114–15; conceptions of, 106–7;
 medical model of, 106, 107;
 orthosis and, 110; prosthesis and,
 108, 110–11; social model of, 107;
 “things” associated with, 103–15
 distancing, 65–66
 DMA. *See* Dallas Museum of Art
- Donovan, Tara, *Untitled*, 61
 Dunhuang frescoes, 6, 33, 34
 Durite Plastics, 32
 dust, 31–32, 33, 35, 123
- Eames, Charles and Ray, 13, 15
 Elmer's Glue-All, 32
 environment: museums' impact on,
 6; plastics' impact on, 1, 3–4, 11, 13,
 31–32, 37, 39–40, 61, 65–66, 101,
 112, 114, 117–28. *See also* pollution;
 toxicity; waste/garbage
 environmental justice, 127
 ethane, 21
 eugenics, 49
 Evans, Tom, 96
 Experiments in Art and Technol-
 ogy, 8
- fiberglass, 8, 54
 film, photographic/motion picture,
 10, 11, 24, 27–28, 29, 38, 92
 Fiofori, Tam, 68
First Russian Art Exhibition (Berlin,
 1922), 78
 Fluxus, 38
 Ford, Henry, 18
 fourth kingdom, 20
 fracking, 127
 Freud, Sigmund, 43, 108
 Friedel, Elizabeth A., 118
- Gabo, Naum, 6, 8, 28, 51–52, 75–87;
 Constructed Head No. 1, 76;
 Constructed Head No. 2, 52, 76,
 77, 78–87, 83; *Constructed Head*
 No. 3 (*Head of a Woman*), 76, 79;
 Constructed Torso, 76; *Construction*
 en Creux, 76; *Construction in*
 Space, Balance on Two Points,
 86; *Construction in Space C*, 76;
 Construction in Space: Two Cones,
 79; *Linear Construction No. 2*, 52,
 53; *Model for Column*, 76; photo-
 graph of the state set of *La Chatte*,
 30, 31; *Realistic Manifesto*, 76
 Gabo, Nina, 82
 Galerie Percier, Paris, France, 78
 Galerie van Diemen, Berlin,
 Germany, 78
 garbage. *See* waste/garbage
- Garbage Project, 58, 60
 Garland-Thomson, Rosemarie, 115
 General Motors Pontiac GTO, 18
 geology: and oil formation, 1, 21, 39;
 plastics and, 39–40, 60, 117, 124
 Geyer, Ronald, 121, 127
 Ghosal, Sutapa, 118
 Glissen, Maria, view of Marcel
 Broodthaers's exhibition at the
 Musée d'Art Moderne, Brussels, 44
 globalization, 65, 68, 70
 glue. *See* adhesives
 Golden, Sam, 27
 Gordon (former enslaved person),
 49
The Graduate (film), 18
 Great Pacific Garbage Patch, 126
 Gruber, Elisabeth, 123
 guncotton, 11, 27–28
 gutta percha, 21
- Hamilton, George Heard, 86–87
 Haram, Linsey E., 39
 Haraway, Donna, 65
 Harrison, Matthew Angelo, 39, 49,
 58; *Lanced Below*, 49, 50
 Harvard Art Museums, Cambridge,
 Massachusetts, 6, 33
 Havel, Václav, 19
 Hawkins, Guy, 127
 HDPE. *See* high-density polyethylene
 Hendren, Sara, 111
 Her Many Horses, Emil, 96
 Hesse, Eva, 3, 8, 10; *Chain Polymers*,
 8; *Repetition Nineteen III*, 8, 9,
 10, 54
 Het Nieuwe Instituut, Rotterdam,
 Netherlands, 61
 Heye, George Gustav, 89
 high-density polyethylene (HDPE),
 132, 133
 Hoffman, Dustin, 18
 horn, 17, 21, 24
 humidity, 4, 6, 13, 27–28, 31
 Hyatt, John Wesley, 17, 21, 27
 hydrocarbons, 21–22
- Indigenous Australians, 98
 inhalation, of plastics, 3, 10–11, 13,
 117, 121, 123–24
 institutional critique, 43

- International Organization for Standardization's Blue Wool standards, 100
ivory, 1, 17, 19, 24
Ivory Rhodoid, 78, 81–82, 84, 85
- Jackson, Zakiyyah Iman, 13, 41, 47, 49
Jafa, Arthur, 39, 49; *Ex-Slave Gordon*, 48, 49
Jain, Sarah, 108
Jambeck, Jenna R., 121
Jazvac, Kelly, 60–61, 125
Jenner, Lauren, 123
Judd, Donald, 52, 54
Jungen, Brian, 24; *Crux*, 94, 97–98, 99, 100
- Kafer, Alison, 107
Kimmerer, Robin Wall, 101
Kitchen, New York, 55
Kuskwogmiut Yup'ik, *Bag*, 90, 91
- Larrow, Aundre: *Kevin Beasley in His Studio*, 131; *Untitled*, 133, 134
latex, 3, 11, 21
Law, Kara Lavender, 121
Le Corbusier, 108
Lenox, Walter, 81
LeWitt, Sol, 54
Liberate Tate, 66
Liboiron, Max, 40, 65, 114
License to Spill (performance), 66, 68
Licht, Sidney, 110
Lichtenstein, Roy, 27
light exposure, 4, 13, 27–28, 31, 100
long chain polymers, 22
Louis, Morris, 27
- Maciunas, George, 38
Magna, 27
Mah, Alice, 127
Malabou, Catherine, 38, 41–43, 45, 47, 51, 54, 70
Maphoto/Riccardo Pravettoni, “How Microplastics Are Generated,” 120
Marcus, Neil, 137n4
Marine Litter Vital Graphics, 119; “How Microplastics Are Generated,” 120
- Marshall, Kerry James, 31
Martyr, Peter, 1
Maximenko, Nikolai A., 39
Maya, 1
Meikle, Jeffrey, 103, 115
metal, conservation of, 33
Metropolitan Museum of Art, New York, 32
Michael, Mike, 127
microbes, oil- and plastics-eating, 124
microplastics: human and environmental impacts of, 6, 10–11, 31–32, 103, 117–28; images of, *frontispiece* (detail), 118, 122; qualities and generation of, 119, 120, 121, 123; ubiquity of, 117, 119, 123. *See also* nanoplastics
Miron, Jerry, 32
Mobil, 68
monomers, 20–23
Moore, Charles, 60, 126
Motor Trend (magazine), 18
Munson, Portia, 61
Murphy, Cullen, 58
Musée National d'Art Moderne, Paris, France, 81
Museum of London, England, 31
Museum of Modern Art (MoMA), New York, 8, 79, 86
Museum of the American Indian, New York, 89
museums: conservationist/archival aspects of, 6, 23–35, 92–102; environmental impact/sustainability of, 6; and plastics, 4, 6; plastics in the objects of, 23–27, 60. *See also* National Museum of the American Indian
- nanoplastics, 121, 124, 126
naphtha, 21
Nash, Steven, 82, 84
National Museum of American History, Washington, DC, 103–4
National Museum of the American Indian (NMAI), Washington, DC, 4, 89–102; Cultural Resources Center, 100–101; works containing plastics in, 92–102, 93
- Natura Artis Magistra, Amsterdam, Netherlands, 61
natural gas, 21, 127
nature, plastics as imitations of materials in, 1, 3–4, 17–19, 24, 33. *See also* environment
Naum Gabo: Sixty Years of Constructivism (exhibition, 1985–86), 84
Nelson, Mallory Kay, 111
New York Condensed Milk Company, 32
New York Times (newspaper), 39
Nielsen, Tobias, 127
Nigeria, 68, 70
Nike, 98
Nixon, Rob, 37
NMAI. *See* National Museum of the American Indian
nurdles, 22, 121
nylon, 23
- L'Oeuvre du XXe siècle* (exhibition, Paris, 1952), 81
off-gassing, 79, 85
oil/petroleum, 1, 4, 21, 39, 68, 101, 127, 132
Oldenburg, Claes, *Mouse Museum*, 60, 62–63
O'Neill, Kate, 66
Oosten, Thea van, 97
orthosis, 110
Osodi, George, *Oil Rich Niger*, 67, 68
Ott, Katherine, 104, 110
- Parkes, Alexander, 17, 27
Penfold, Arthur de Ramon, 23
Perez-Reyes, Ana C., 118
PET. *See* polyethylene terephthalate
petroleum. *See* oil/petroleum
Pevsner, Antoine, 6, 8, 10, 11, 31, 52, 76, 81, 86; *Portrait of Marcel Duchamp, front cover* (detail), 7, 8, 87; *Torso*, 8
Pevsner, Virginie, 81
Pez candy, 94
Phelan & Collender, 17
phenol formaldehyde, 21
phenolic resin, 21
photography, 10, 27
plasticene, 39, 40, 117, 119, 127
Plastic Identification Tool, 92, 94, 101

- plasticity: of Black bodies and minds, 13, 47, 49; of bodies, 13, 15, 49, 54; of the brain/self, 38, 42–43, 47, 54; as core feature of plastics, 10, 37–39, 70, 111, 123; dialectical/tripartite concept of, 38, 42, 45, 49, 51–52, 55, 58; globalization and, 65–66, 68, 70; of language, 43; negative connotations of, 19
- Plastic People of the Universe, 19
- plastics: aesthetics/art history of, 37–39, 41–65, 70; in an artist's studio, 129, 132–34; art materials/media/works containing, 10, 23–27, 37–38, 41, 51–65, 75–87, 92–102; atmospheric qualities/inhalation of, 3, 10–11, 13, 117, 119, 121, 123–24, 126; and the body, 13, 15, 103–15; chemical and material qualities of, 20–23; contradictions/paradoxes of, 4, 15, 19–20, 37–42, 102, 127; dating of objects containing, 22; derived from oil/petroleum, 1, 4, 21, 39, 101, 127, 132; disposability of, 61, 65, 112, 127; durability/non-degradability of, 22, 39; environmental impact of, 1, 3–4, 11, 13, 37, 39–40, 61, 65–66, 101, 112, 114, 117–28; as a fourth kingdom, 20; geology of, 124; globalization and, 65–66; government actions against, 13; hygienic functions of, 37, 55, 58, 132; identification standards for, 22–23; imitative function of, 1, 3–4, 17–19, 24; instability/degradation of, 6, 8, 10, 11, 27–28, 31, 51, 75–76, 85, 87, 123; life and death associated with, 39–41, 112; life cycle of, 6, 23; museums and, 4, 6, 23–35, 60; origins of, 1, 4, 19; popular connotations of, 18–19, 54; protective functions of, 33, 35, 37, 55, 100; single-use, 10, 39, 61, 112, 114, 132–33; smell of, 11; temporality of, 39; toxicity of, 4, 37, 39–40, 61, 65, 68, 101, 112, 123; ubiquity of, 13, 37, 39, 41, 102, 103. *See also* conservation and archival concerns with/uses of plastics; microplastics; nanoplastics; plasticity; polymers; toxicity; waste/garbage
- Plastics Industry Exhibition (Sydney, Australia, 1934), 23
- plastiglomerate, 39, 60–61, 124, 125
- plastisphere, 40
- Pollock, Jackson, 27, 51
- pollution: effect of, on plastics in art works, 79, 85–86; plastics as source of, 40–41, 58, 65, 68; sources of, 114. *See also* toxicity; waste/garbage
- polycarbonate, 23, 100
- polyethylene, 22, 94, 100, 133–34
- polyethylene terephthalate (PET), 22, 24, 94
- polylactic acid, 23
- polymers: art materials/media containing, 10; formation of, 20, 22; Hesse and, 3, 8, 10; identification of, in works in NMAI, 94; long chain, 22; the Maya and, 1; natural, 21, 92; semisynthetic, 21; synthetic, 21. *See also* plastics
- polypropylene, 22, 23, 100, 132
- polystyrene, 23
- polyurethane (PUR), 11, 27, 31, 35, 55, 94, 97, 129, 134
- polyvinyl acetates, 33
- Powerhouse Museum. *See* Technological Museum, Sydney, Australia
- powwow regalia, 94, 95, 96–97
- Princen, Thomas, 65
- Project Plastics Group, 94
- propene (propylene), 21
- Proper, W.A., 31
- prosthesis, 108, 110–11
- PVC, 22, 27, 31, 94, 97
- pyroxyline. *See* guncotton
- race, plasticity and, 13, 47, 49
- Rao-Middleton, Ananya, panel from “What I Wish Non-Disabled People Understood about Disability and Plastic,” 113, 114
- Rathje, William, 58, 60
- Rawlins, Makayla, 92, 94, 101
- recycling, 22–23, 121
- rehabilitation technology, 106–15
- resin: acrylic, 27; art works containing, 8, 10, 11, 54, 58; conservationist/archival uses of, 11, 33; identification standards for, 22–23; in Native American art, 92; phenolic, 21; plastics as imitations of, 1; polyurethane, 11; synthetic replacements for natural, 33
- Resin Identification Code, 22
- Rhodoid, 78
- Richards, Penny, 104
- Riley, Duke, 24; *No. 363 of the Poly S. Tyrene Memorial Maritime Museum*, 24, 25
- Ritchie, Andrew Carnduff, 86
- Roberts, Jody A., 40, 112, 114
- rubber, 1, 3–4, 11, 21, 32, 92, 94; cast of, 5; trees, 2
- rubberized flannel, 96–97
- Ruiz, Gregory M., 39
- safety film, 28
- San Ildefonso, 92
- Santo Domingo Pueblo jewelry, 91–92, 94
- scent, 55
- Schänbein, Christian Friedrich, 27
- scrimshaw, 24
- Sebille, Erik van, 123
- semisynthetic polymers, 21
- shellac, 1, 21, 32
- Shew, Ashley, 111
- single-use plastics, 10, 39, 61, 112, 114, 132–33
- Siqueiros, David Alfaro, *Cosmos and Disaster*, 24, 26
- Skeist, Irving, 32
- Smithsonian Institution, 89
- Smithsonian Museum Conservation Institute, 100
- Sobchack, Vivian, 110
- Société Anonyme, 86
- Société des usines chimiques du Rhône, 78
- Society of the Plastics Industry Inc., 22
- solvents, 80
- Song Dong, *Waste Not*, 61
- Standard Practice for Coding Plastic Manufactured Articles for Resin Identification, 22
- Standing Rock Sioux, 4, 101

- State Museums, Berlin, Germany, 32
 Stevens, Bethany, 111
Strange Comfort (exhibition, Washington, DC, 2009–10), 98, 100
 Straus Center for Conservation and Technical Study, Harvard Art Museums, 33
 straws, 13, 112, 114–15
 Striker, Henri-Jacques, 108
 studio, plastics in an artist's, 129, 132–34
 Summerour, Rebecca, 97
Sunday Telegraph (Sydney newspaper), 24
 sustainability, 6, 127
 Sweeney, James Johnson, 81
 Sydney Technical College, Australia, 23
 synthetic paints, 24, 27
 synthetic polymers, 21
Synthetic Resins and Their Plastics, 33

 Tamayo, Steve, 96, 97
 Target, 96
 Tate Britain, London, England, 66, 68
 Tate Gallery, London, England, 81
 Tate Modern, London, England, 55, 66
 Technological Museum, Sydney, Australia, 23–24
 temperature, 4, 6, 13, 27–28, 101
 thermoplastics, 21
 thermosets, 21
Third Report of the British Museum on the Cleaning and Restoration of Museum Exhibits, 33

 Thompson, Richard, 124
 Tiger, Robert, Jr., northern-style dance outfit, 94, 95, 96–97
 time: geological, 1, 21, 39; plastics and, 6, 8, 39, 75, 85, 134
Time (magazine), 91
 titanium dioxide, 79
 Toplis & Harding, 81
 tortoiseshell, 17, 19, 21, 24
 toxicity, of plastics, 4, 37, 39–40, 61, 65, 68, 101, 112, 123. *See also* pollution
 triphenyl phosphate, 28
 Turley, Jake, 104, 106–7, 110–11, 114–15

 Uddenberg, Anna, 55, 58; *FOCUS #2 (Pussy Padding)*, 55
 U.S. Food and Drug Administration, 132

 vinegar/vinegar syndrome, 11, 28
 vinyl, 22, 55, 92

 Wadsworth Atheneum Museum of Art, Hartford, Connecticut, 82
 Wagner-Lawlor, Jennifer, 68
 Walmart, 96
 Warhol, Andy, *Silver Clouds*, 61, 64
Washington Daily News (newspaper), 82
 waste/garbage, 4, 24, 37, 39, 40, 55, 58, 60–61, 66, 68, 70, 112, 121, 124, 126. *See also* pollution
 waterways, plastics in, 124, 126
 Weems, Jason, 13
 Welles, Orson, 28

 Wels, Charles, *Celluloid Grand March Op. 4*, 17, 18
 West, Rick, 96
 Whitney Museum of American Art, New York, 11
 Wilson, Charles, 81, 82, 84
 Wilson, Kristina, 13
 Wong, Alice, 112, 114
 Woolworth's, 92

 Yale Peabody Museum, New Haven, Connecticut, 61
 Yale University Art Gallery, New Haven, Connecticut, 8, 86–87
 Yi, Anicka, 54–55; *Le Pain Symbiotique*, 55; *You Can Call Me F*, 55
 Yonkos, Lance T., 118

 Zalasiewicz, Jan, 124
 Zappa, Frank, 19
 zinc oxide, 79
 Zipatone, 27