



Battle of the Bag

IT'S NOT ALWAYS easy to see when a relationship is in trouble. People have been known to cut down their forests, exhaust their local water supplies, and deplete their soil, failing to recognize or understand the natural foundation for human existence. Plastics seemed to promise a new foundation for human life: food comes sliced and diced and packaged in plastic; sports are played on grass made of plastic; homes are wrapped in plastic; and every year brings new time-saving devices and electronic miracles encased in plastic.

Now we've begun to acknowledge there is trouble in this relationship, perhaps deep trouble. But we've been together so long it's difficult to imagine a different world, one in which people determined the fate of plastic, rather than the other way around.

And yet a small but determined group have begun to imagine that world. They've realized that the best way to prevent the oceans from choking on plastic debris is to better manage that debris on land, which means, among other things, curbing human reliance on throwaways. As a start, they've trained their sights on the most ubiquitous of all throwaway items: the plastic shopping bag. The bag may not be any more pernicious than foamed polystyrene cups or picnic

forks or carryout clamshells, but it's the single-use item that, more than any other, has aroused popular ire. People the world over are calling for the bag's abolition, from community activists who view it as very nearly the spawn of Satan to the somewhat more staid head of the United Nations Environment Program who contends that "there is simply no justification for manufacturing them anymore, anywhere."

In 2007, San Francisco became the first U.S. city to ban plastic grocery bags, joining dozens of other cities and countries on every single continent that have taken moves to rid themselves of the bags. Inspired by San Francisco, local governments across the United States — from Plymouth, Massachusetts, to sunny Maui — announced their own measures to eliminate plastic bags, as did major retailers such as Ikea, Whole Foods, Walmart, and Target. All told, more than two hundred anti-bag measures have been introduced in the United States, and although the plastics industry has successfully defeated or derailed many of those measures, activists as well as industry insiders predict that eventually the plastic bag as we know it will disappear — at least from grocery stores. (There are countless other types of plastic bags we rely upon.)

It's not hard to see why the bags have become a favorite target. They are virtually without substance — evanescent puffs of polyethylene, transient and yet ubiquitous. They are designed for a brief use but remain with us seemingly forever as a visible and costly source of litter — hanging from trees, plastered against fences, tumbling across beaches — as well as a potential threat to marine life. They do cause real harm, but their symbolic weight is even more significant. They've come to represent the collective sins of the age of plastic — an emblem "of waste and excess and the incremental destruction of nature," as *Time* magazine put it. The bags signify the overpackaged world we all love to hate; they're the totem of all the ways in which "the plastics industry has helped turn us into a disposable society," as one anti-bag activist complained.

Often when we find ourselves caught in a relationship that makes us feel bad or guilty, we want to be rid of it as quickly as possible. Yet

in the rush for a quick divorce, we may just find ourselves falling into a rebound romance that is no healthier than the one we just left.

How did we get hooked on plastic shopping bags?

For a century, imaginative entrepreneurs eyed the protean possibilities of plastic and asked: Which natural substances can these wonder materials replace? It was not a question that went uncontested. As the editor of the trade journal *Modern Plastics* observed in 1956, "Not a single solid market for plastics in existence today was eagerly waiting for these materials." Each new plastic product faced "either fearsome competition from vested materials or inertia and misunderstanding in acceptance, all of which had to be overcome before plastics gained a market."

The fight to conquer the checkout counter was part of plastic's long and steady incursion into the general field of packaging. About half of all goods are now contained, cushioned, shrink-wrapped, blister-packed, clamshelled, or otherwise encased in some kind of plastic. Indeed, one of every three pounds of all plastic produced is used for packaging, including the now ubiquitous grocery bag that wraps itself around your fingers at every opportunity. The push into packaging began in the late 1950s, as plastic challenged one after another of paper's strongholds. Soon, sliced bread was being sold in plastic bags, and waxed paper was being replaced by sandwich baggies. Dry cleaners abandoned heavy paper bags in favor of polyethylene sacks.

That last shift, however, sparked a national crisis in 1959, with a flurry of news reports that the new filmy bags could kill: eighty babies and toddlers had been accidentally suffocated, and at least seventeen adults had used them to commit suicide. In the ensuing "bag panic," dozens of communities proposed banning the bags, confronting the industry with its first major threat. The manufacturers of film plastics scrambled to save their fledgling industry, spending close to a million dollars on a national education campaign to warn consumers about the dangers of the diaphanous bags while also developing new industry standards to make them thicker and less clingy. Meanwhile, the head of the Society of the Plastics Industry (SPI) pledged to run

newspaper and radio ads "until there is not a mother, father, boy or girl in this country who does not know what a plastic bag is for . . . and what it is not for." The combined measures shut down the calls for bans. As Jerome Heckman, the lawyer who for decades represented the SPI through the bag panic and countless later fights, recalled, "Our job was and should always be to open plastics markets and keep them open."

One of the companies with a huge vested interest in opening new markets was Mobil Oil, then the leading producer of polyethylene film. By the time a young college graduate named Bill Seanor joined Mobil in 1966, the company had already developed an extensive line of substitutes for paper packaging. Its bag-on-a-roll had replaced paper sacks in grocers' produce sections, and its Hefty trash bags had helped alter people's longtime habit of lining their garbage pails with newspaper. Restless for new possibilities for polyethylene film, in the early 1970s Mobil began eyeing one of the most lucrative paper products of all — the retail shopping bag. In fact, said Seanor, the company had already spent years and millions of dollars trying to develop a square-bottomed, stand-up plastic version of the classic brown paper bag. "The conventional wisdom was that you had to have the same thing." But because the copycat bag priced out higher than paper, "it never got off the ground."

Then Mobil officials caught wind of a grocery bag that a Swedish company was distributing in small numbers, mainly in Europe. Its inventor, Sten Thulin, had come up with a design unlike any traditional paper bag. Solving technical problems that had stymied other inventors before him, Thulin devised an ingenious system of folds and welds that made it possible to transform a flimsy tube of polyethylene film into a strong, sturdy bag. In its 1962 patent drawings, the bag looked like a sleeveless scoop-neck T-shirt, hence the name now widely used by the industry: the T-shirt bag.

According to Seanor, who oversaw the company's early foray into the production of T-shirt bags, Mobil executives immediately recognized it was the bag for them. They could see that, unlike Mobil's initial design, this bag had the punch to knock paper from its perch at

the checkout stand. Indeed, the bag ultimately proved so popular with retailers precisely because it wasn't like the traditional flat-bottomed paper sack. Thulin drew on the distinctive virtues of polyethylene to create a wholly new kind of bag. Today the bag is so maligned that we forget what an engineering marvel it is: a waterproof, durable, featherweight packet capable of holding more than a thousand times its weight.

Seanor and his colleagues may have been excited about the bag they introduced to the United States in 1976 (the inaugural versions were decorated in red, white, and blue in honor of the U.S. Bicentennial), but shoppers were underwhelmed. They didn't like the way a checkout clerk often licked his fingers to pull a plastic bag free from the rack, or the fact that the bags wouldn't stand up, Seanor remembered. "People would get their groceries, take them out to the car, and they'd fall over, and consumers would be madder than hell." And when shoppers were unhappy, it was grocers who caught the flak.

It was clear to the budding bag industry that to win over consumers, it would have to win over grocery stores first. One trade group, the Flexible Packaging Association, launched a public relations campaign that urged grocers: "Check Out the Sack. It's Coming on Strong." Meanwhile, the bag companies reached out directly to stores with educational programs to help grocers overcome shoppers' distaste for the bags. "We put together training programs that told the store how to actually pack plastic sacks," said Seanor, who eventually left Mobil with a few colleagues to start their own plastic-bag company, Vanguard Plastics.

But the most persuasive factor in the new bags' favor was basic economics: plastic bags cost a penny or two, paper bags cost three to four times as much, and because they were heavier and bulkier, they were more expensive to transport and store. Two of the country's biggest grocery chains, Safeway and Kroger, made the switch to plastic bags in 1982, and most of the other major chains soon followed suit. "Once we started getting the Krogers of the world to change,

it was pretty much over," recalled Peter Grande, a veteran of the business and now head of a Los Angeles bag company, Command Packaging. There were still occasional skirmishes with paper-bag makers over regional markets, he said. "But the feeling within the plastics industry was 'this is the future — plastic is going to dominate the landscape.'"

The accuracy of that prediction would come back to bite the industry. Plastic bags were so cheap to produce and distribute that, in the inexorable logic of a free market, they were bound to proliferate. Producers would, of course, make as many as they could sell, and grocers had no incentive to ration them. Purchase a few items at the grocery store, and between double bagging and sloppy packing, you might walk out with a dozen bags. (Which in turn gave rise to a whole new market niche: plastic products to hold used plastic bags. I've got two bag organizers in my broom closet.) By the new millennium, the T-shirt bag had become perhaps the most common consumer item on the planet. Worldwide, people used somewhere between five hundred billion and one trillion bags a year — more than a million a minute. The average American was taking home about three hundred a year. And yet like so much plastic packaging, the vast majority of these bags wound up in the trash — or worse.

When plastic first began to penetrate the packaging market, it was promoted for its durability, not its disposability. The reason babies in the 1950s could suffocate on dry-cleaning bags was that people were holding on to them for other uses — as DuPont had encouraged when it first introduced the bags. What's more, those early bags were pricey. "Keep [your] clear plastic bags . . . Clean inside and out with a few dabs of a sudsy sponge," an outfit called the Cleanliness Bureau advised readers of the *New York Times* in 1956. "Dry the bag promptly and it will stay lovely for many seasons to come."

But it didn't take long for the industry to recognize that disposables were the route to growth, and for a prosperous public to get comfortable with the idea of throwing plastic packaging away. Especially as that packaging multiplied. Today, the average American throws out

at least three hundred pounds of packaging a year; Americans' combined mountain of stripped wrappings and emptied containers accounts for a third of the total municipal waste stream.

Plastic grocery bags would become that stream's most potent symbol.

Mark Murray had plastic bags in his cross hairs long before the current wave of anti-bag warriors did.

Murray is executive director of Californians Against Waste, a statewide group that was formed in 1977 to push for the passage of a bottle bill in California. Its mission has since broadened to encompass a range of waste-related issues, from electronics recycling to dairy-farm refuse. One reason California has long been on the leading edge of solid waste legislation is CAW and, by extension, Murray. He's spent his entire career with the group, having joined as an intern in 1987—a fresh college graduate and political junkie who arrived in Sacramento in search of a job. He had no great interest in recycling, but for someone with an intensely competitive nature, the issue turned out to be ideal. As a reporter profiling Murray once observed: "It provided battles that were winnable—not like saving the whales or shutting down nuclear power." He may have just stumbled across the issue, but recycling—really, the whole megillah of waste reduction—quickly became an obsession. At the same time, he became well practiced at balancing his idealistic goals with the demands of realpolitik. He's a pragmatist who's open to compromise, at times too much so, according to critics to his left.

Now in his forties, Murray has close-cropped hair with a sharply receding hairline and the zero-body-fat frame of a long-distance runner. Indeed, he's a competitive marathoner, and such endurance is a useful quality when one is a lobbyist for a nonprofit with long-range goals. Murray knows what it is to keep pushing ahead with his sights fixed on a distant finish line. He's been hoping to get rid of plastic shopping bags for more than twenty years.

According to Murray, some waste questions are complicated, but not the ones surrounding plastic bags. "The plastic bag is a problem

product," he said flatly when we met for lunch one fall day when the legislature was out of session. "I'm not out there suggesting that we should ban every plastic product. But there are some whose environmental costs exceed their utility, and the bag is one of them."

Murray's chief gripe about the bag is not the oft-cited one: that they clog up valuable landfill space. In fact, studies have shown that plastic bags and other plastic trash take up much less space in landfills than paper waste or other materials, in part because plastic can be more tightly compressed. Nor is Murray concerned that plastic bags can "last hundreds of years in a landfill," which was one of the stated reasons for a bag ban proposed in Fairfield, Connecticut. Nearly all trash—no matter the material—can endure in a landfill. Archaeologist William Rathje—self-proclaimed "garbologist" for his studies of landfills—has unearthed newspapers from the 1930s that were as clear as yesterday's edition, and decades-old sandwiches that looked fresh enough to eat.

Murray isn't worried about what happens when bags get into landfills; he's upset that so many don't. Sometimes litter accumulates when a person carelessly tosses a cigarette butt or soda can to the ground, he explained. "But the plastic T-shirt bag often becomes litter *after* it has been properly disposed of. The plastic bags blow out of garbage cans, they blow out of the back of garbage trucks, off transfer stations and off the face of landfills." They are intrinsically aerodynamic. Indeed, they're even more aerodynamic now than they used to be. In response to an earlier generation of environmentalists' concerns about landfill space, bag makers have made them even lighter and thinner.

Yet unlike paper litter, when plastic bags get into the environment, they don't biodegrade. Twenty years ago, Murray staged what he called a press stunt to illustrate that problem: he tacked a bunch of paper and plastic bags onto the roof of a downtown Sacramento building. Sure enough, as the weeks went by, the paper bags gradually melted away, but the plastic bags just slowly shredded into smaller and smaller pieces.

The environmental implications of that persistence is what has

driven many activists—especially those concerned with marine debris—to do battle against the bag. Murray, however, is mainly motivated by concerns about waste—the ever-growing impact of our throwaway culture. He’s an advocate of zero waste, a concept that has been gaining ground among policymakers over the last decade or so, especially in California, where several state agencies and a number of counties and cities have adopted it. Zero waste is less a concrete goal than a guiding principle for policies designed to dramatically reduce the torrent of trash we now bury in landfills and burn in incinerators. More than a prescription for diverting garbage into recycled goods or compost, zero waste embodies a broad ethic aimed at lightening the load we’re imposing on the planet. Zero-waste policies encourage people to reduce consumption while also pushing industry to extend the lifespan of the things we use by designing and producing products that can more readily be reused, repaired, or recycled. At its essence, zero waste is an ethic of resource conservation that would seem thoroughly familiar to our great-grandparents.

The plastic bag is a fundamental affront to that ethic. It’s made up of resources that were a hundred million years in the making, and yet its useful lifespan is measured in minutes—just long enough, Murray said, “to get my groceries from the store to my front door.” The bag can’t be repaired. It’s not easily recycled. And the number of times it can be reused is limited. Bags may see double-duty carrying lunch, picking up dog poop, and lining trash cans, but studies show a plastic bag has to be used *at least* four times to mitigate the environmental impact of all that goes into making and disposing of it. Paper bags have similar environmental impacts, but they don’t cause long-lasting litter and they are readily recycled. In Murray’s zero-waste world, we’d all be carrying reusable bags. But for years he couldn’t get anyone, aside from members of environmental groups, interested in attacking the problem of wayward bags.

Then Charles Moore sailed his catamaran into the North Pacific plastic vortex and lifted the curtain on the back end of our throwaway lifestyle. This dystopian vision was especially disturbing to beach-blessed California, a place that sees the ocean as its backyard.

The state’s long coastline is a priceless natural treasure—a draw for its forty-six-billion-dollar tourist industry; a rich and diverse fishery; a mecca for surfers, sailors, swimmers, and scuba divers. Eager to safeguard that resource, California’s Ocean Protection Council had called for the curbing of all single-use plastic products through fees and bans. In a state of beach lovers, even free-market conservatives like the Republican governor Arnold Schwarzenegger considered the bags a big enough problem they were ready to bid them *hasta la vista*. Bag litter was what turned Schwarzenegger against the bags. “Trash on the beach has always been Arnold’s pet peeve. He can’t stand it,” explained Leslie Tamminen, an environmental activist who worked with Schwarzenegger and was instrumental in assembling a broad coalition that pushed for a statewide ban on the bags in 2010.

How much do the bags contribute to that vast offshore swirl of debris? No one can say for sure. They’re a hazard to sea life, but probably not as great a threat as ghost nets or the hard plastic microdebris that’s most prevalent in the gyre. Still, bags are colonizing beaches like a new invasive species: volunteers in the 2008 international beach cleanup picked up nearly 1.4 million. No doubt some were cast off by careless picnickers. But surveys suggest that most come to ground miles inland and reach the ocean via storm drains and waterways. A study in Los Angeles County found that 19 percent of storm-drain litter was plastic bags. That’s bad news for California coastal communities because most are under a federal order to keep their storm drains clear of trash that can be swept into the ocean. Complying with the mandate has cost Southern California cities more than \$1.7 billion since the 1990s. For those communities, bag debris was potentially “a huge financial burden,” said Murray. So by the early 2000s, “you had moderate and conservative local government officials in Southern California also clamoring about the problem of plastic bags, not just environmentalists.”

For the first time in his long tenure at CAW, Murray saw a real political opening to move against T-shirt bags. If enough local communities took up the bag issue, it would provide ammunition for a fight at the state level. In his experience, that was the way to win the

support of the politically powerful grocers and retailers, who much preferred a consistent statewide policy to a patchwork of local regulations. Declaring war on plastic bags suddenly looked politically feasible.

Then San Francisco fired the first shot, setting off a political chain reaction that put the city, and ultimately the entire state, on the frontlines of the bag wars.

San Francisco prides itself on being at the forefront of green policy-making. There are charging stations for electric cars in front of city hall. Residents get tax credits for installing solar panels. City trucks collect used grease from restaurants for the biodiesel-powered fleet of municipal vehicles. The city has one of the most aggressive recycling programs in the country, recycling or composting over 70 percent of its waste and sending less than 30 percent to landfill—the exact reverse of the national ratio. In 2002 city leaders adopted zero waste as a goal, pledging to reduce that 30 percent to nothing by 2020.

City leaders already tilted green, but they had very practical reasons for targeting bags. City grocery stores were handing out 180 million bags a year, and all this clingy, flyaway plastic was wreaking havoc at San Francisco's state-of-the-art recycling plant. People weren't supposed to put the bags in their recycling bins, but invariably people did. At the recycling facility, the bags would come loose, flutter around, and gum up the works. The plant had to shut down twice a day or more so that workers armed with box cutters could manually cut out plastic bags wrapped around the conveyor belts. Plastic bags were costing the facility about \$700,000 annually.

There were other costs as well, according to Robert Haley, a longtime staffer in the San Francisco Department of Environment who is in charge of shepherding the city toward its goal of zero waste. In fact, when Haley totted up all the problems related to plastic bags—at the landfill, the recycling center, as litter on the streets and in parks—he estimated the cost to San Francisco at \$8.5 million a year, admittedly a tiny part of the city's multibillion-dollar budget, but in Haley's view, a needless expense for the deficit-plagued city. The bags may have

been a nice convenience for San Francisco shoppers. But the price of that convenience, Haley reckoned, was higher than the city could afford.

A ban on the miscreant bags was one obvious solution. The city of Mumbai had done it in 2000 after determining that plastic bags clumping in storm drains had dramatically worsened monsoon floods. The city even set up a special police squad dedicated to ferreting out and fining shops and factories that violated the ban. Other Indian cities followed Mumbai's lead with bag bans of their own, as did Bangladesh, Taiwan, Kenya, Rwanda, Mexico City, parts of China, and other places in the developing world.

But rather than an outright ban, Haley—and Murray, who was working with him—were more intrigued by the idea of putting a price on the bags as a way to discourage their use. Their model was Ireland, which in 2002 levied a fifteen-cent fee on plastic bags, a so-called plastax. Within weeks, use of the bags dropped 94 percent and the amount of plastic bag litter decreased significantly. Carrying a plastic bag in Ireland quickly became about as socially acceptable as “wearing a fur coat or not cleaning up after one's dog,” noted one reporter. The plastax generated twelve to fourteen million Euros in annual revenue that was dedicated to defraying the program's costs and to supporting a variety of environmental programs. Although the fee wasn't popular at first, the Irish soon accepted it, and one study even found that “it would be politically damaging to remove it.”

Such fees serve as a way to make visible the social costs of a product. We may be used to paying nothing for grocery bags, but that doesn't mean they have no cost. Instead the costs have shifted elsewhere—tucked into the price of food, or showing up in taxes that are necessary to deal with the environmental impacts of the bags' production and disposal. Murray and Haley believe fees shine a light on the environmental costs of products, which can ultimately change consumer behavior and promote better product design.

Any type of single-use bag, paper or plastic, has environmental costs. Each drains down finite resources for the sake of an almost trivial convenience. “You pay for everything else in the store,” Haley

observed. “Why shouldn’t you pay for bags?” A fee ought to persuade people to kick the single-use habit altogether and start bringing their own reusable bags.

So with that goal in mind, in 2004 Haley and his staff put together a proposal urging the city to levy a fee on all grocery bags—paper as well as plastic. They set it at seventeen cents, the estimated cost of each bag to the city. City supervisor Ross Mirkarimi, also a zero-waste advocate, was happy to sponsor it.

The proposed fee was controversial—opposed by retirees on fixed incomes, grocers who didn’t want to inconvenience their customers, and, of course, the plastics industry, which blasted it as a “tax [that] is going to hurt those who can least afford it.” Using the volatile word *tax* to describe a fee that could easily be avoided by bringing one’s own bags would be one of the industry’s consistent and most effective strategies in skirmishes to come.

While Mirkarimi was trying to muster the support he needed, the grocers and bag makers teamed up for an end run around the city. They went to the state capital to push for statewide legislation to head off San Francisco’s fee plan and “keep this issue from going crazy,” as one industry lobbyist put it. The result was a law requiring all major grocery stores to offer bag recycling, but another key provision preempted cities and counties from imposing fees on plastic bags. One of the best options for dealing with the problems of single-use plastic bags in California had been gunned down.

Murray, to the fury of many environmentalists, helped draft that legislation. Ever the pragmatist, he considered it a transitional measure that would move the state one step closer to getting rid of the bags. Within a year or two, he figured, it would be clear that store-based recycling didn’t work and didn’t reduce bag consumption, and he could go back to legislators and say, *See, we told you so. Now let’s put a fee on the bags or ban them.*

But he didn’t anticipate the explosive effect of limiting cities’ choices. Local governments don’t like being told what to do by state government, especially on a traditionally local matter like waste disposal. “Telling them they couldn’t enact a bag fee just motivated the

hell out of them to do something,” said Murray. “This lit a fire under the San Francisco Board of Supervisors that hadn’t existed there before.” Mirkarimi called it “the ricochet that became my ammunition.”

With that new ammo, he wrote up a proposal to simply ban plastic bags. The formerly reluctant board of supervisors passed it nearly unanimously, and Mayor Gavin Newsom signed it in April of 2007. The new law barred the major grocery stores and pharmacies from giving out T-shirt bags unless they were made of a compostable plastic. (San Francisco is one of the few cities that can handle such plastics, thanks to its extensive composting program.) The stores could still distribute paper bags, leaving San Franciscans free to continue their single-use bag habits. Haley didn’t entirely like it, but he rationalized that paper bags could be recycled or composted, and if one ended up on the ground or in the Bay, it would quickly biodegrade. “One good rain and it will go away.”

Inspired by San Francisco’s example, cities around the country began drafting measures of their own, nearly all aimed solely at plastic bags and most calling for flat-out bans. Lawmakers in a rural Virginia county were motivated by complaints that escaped bags got caught on cotton plants and mucked up the harvesting and ginning equipment. Philadelphia city councilmen were worried that bags were clogging the city’s antiquated sewer systems. Residents of a small Alaskan town were moved to action by bags dangling from willow bushes in the tundra. Coastal communities like the Outer Banks counties in North Carolina and the San Diego suburb of Encinitas cited the issue of marine debris.

Strikingly, these political uprisings were entirely local in character. Unlike attacks on other types of plastic products, this battle had no national drive to “ban the bag.” The campaigns against PVC and phthalates and bisphenol A have all been shepherded by well-established environmental groups—Greenpeace, Health Care Without Harm, the Environmental Defense Fund, and others—using the media and the Internet to generate public pressure so that even if lawmakers don’t respond to consumers’ concerns, retailers might. And indeed, while federal regulators are still considering

what to do about bisphenol A, big-box stores have stopped carrying baby bottles that contain the chemical. Such coordinated efforts help explain how, to paraphrase *Fortune* magazine, Walmart became the new FDA. But anti-bag initiatives genuinely sprang from the grass roots, proposed by local activists or officials acting more or less on their own—and not always for the most well-thought-out reasons. One industry lobbyist derided it as the *Sixty Minutes* phenomenon: “you see something in the paper and then on TV and it gives you a legislative thought.” The popularity of bans was also surely enhanced by what one writer called their “righteous simplicity.” Unlike a fee, a ban didn’t ask much of anyone—except the plastics industry.

For an industry that’s taken plenty of knocks throughout its history, plastics manufacturers were surprisingly slow to respond to the growing anti-bag phenomenon. Bag makers based in California had recognized since the early 2000s that serious trouble was brewing. They could see that the marine-debris issue had very long legs and that sooner or later those legs would start kicking the hell out of their industry. Many actually shared environmentalists’ concerns about the plastic vortex and wanted to address what role bags and other plastic products played in creating the problem. They tracked the bag bans and fees being enacted in other countries and watched with alarm the emergence of groups like Southern California’s Campaign Against the Plastic Plague, which aimed to eradicate not just plastic grocery bags but all single-use plastic packaging. “This is not a wacko group whose ideas can be shrugged off,” the California bag makers warned in their newsletter.

But the American Chemistry Council, the Washington, D.C., voice of the petrochemical industry, seemed oblivious to the growing public concern over marine debris. (Well, not entirely oblivious. In 2004, a spokesman for the group commandeered the Web address, plasticdebris.org, that the California Coastal Commission had hoped to use for a campaign on marine debris.) The ACC could take comfort in industry polls showing that most manufacturers considered the issues roiling California to be irrelevant outside of that state.

“Our industry has been really slow in picking up on the ocean debris problem,” said Robert Bateman, a bag manufacturer in Oroville, California, when I visited him a few months after San Francisco enacted its ban. His company makes heavier-gauge bags than the grocery-store giveaways, so he wasn’t personally affected by the push to eradicate T-shirt bags. But the growing antiplastics fervor was frustrating to him since he considered polyethylene a far more earth-friendly material than paper. He’d been predicting a backlash against bags for many years, ever since he first started hearing reports about plastic trash washing up on beaches in the early 1990s. He’d worked with Charles Moore to develop environmental standards for containing plastic pellets and had long pressed the big trade groups to start addressing the issue of marine debris, not just for business reasons but for ethical ones as well. “My family was in the asbestos business,” he explained. “We learned the hard way that not facing up to issues is not the best way.”

The fragmented nature of the industry may partly account for its inability to appreciate Bateman’s alarms. The plastics industry is less a unitary world than a collection of planets in their own distinct orbits. The huge, multinational petrochemical companies that make plastic resins operate in a separate realm from the mostly domestic companies that make plastic products. Historically, each group has had its own trade association, conferences, business issues, and political agendas. The resin makers are represented by the American Chemistry Council (ACC), an immensely wealthy trade group with annual revenues of more than \$120 million, a staff of 125, four satellite offices, and a roster of issues that reaches far beyond plastics. The products and equipment manufacturers rely on the Society of the Plastics Industry (SPI), a smaller outfit with an operating budget less than a tenth the size of the ACC and a staff of fewer than forty. In the past, the SPI was plastic’s prime defender, but in recent years, the group has focused mainly on trade issues and left it to the ACC to serve as the voice of plastics on high-profile issues. Until recently, bad blood between the two groups kept them from cooperating.

Likewise, the world of manufacturers is fractured along provincial

lines, with little sense of shared community between, say, a company that injection-molds car parts and one that extrudes grocery bags. So other sectors of the industry didn't feel threatened in the same way that the bag makers did. "We weren't getting any support from the broader industry groups because their ox wasn't getting gored," said Seanor, the Mobil executive who helped introduce the T-shirt bag to America. T-shirt bags may be a hugely visible plastic product, but they make up a minuscule fraction of the plastics business—about \$1.2 billion of the \$374 billion American plastics market. Why would the rest of the industry rally behind such a flimsy flag?

It wasn't until San Francisco began developing its bag-fee proposal that the major national T-shirt-bag manufacturers—all of whom were based outside of California—finally sat up and took notice. "We said, 'This will not be good for us,'" recalled Seanor. He and Vanguard cofounder Larry Johnson tried appealing for help to the SPI but were rebuffed. Realizing they had to take matters into their own hands, they called a meeting of the country's five biggest T-shirt-bag manufacturers, inviting them all to gather at the American Airlines Admirals Club lounge in the Dallas/Fort Worth International Airport. Attending were executives from Interplast in New Jersey, API in New Orleans, Sunoco in Philadelphia, Superbag in Houston, Vanguard in Dallas, and a gaggle of lawyers. Each company agreed to kick in money to hire a lobbyist and develop a pro-bag campaign. The first year's funding totaled about \$500,000, though in later years, various of the companies contributed more.

For the next two years Johnson and other bag executives traveled around the state of California trying their damndest to quell the rising antiplastics tide. The effort was a full-time job for Johnson until he succumbed to pancreatic cancer in 2007. The group thought it had bought the bag industry some time by securing passage of the state law requiring grocery stores to recycle bags. But that backfired when San Francisco responded with its ban, triggering a wave of like-minded measures. It had taken years for the industry to beat out paper in the packaging market, and now that hard-won dominance was in danger of disappearing.

What's more, bags weren't the only plastic product coming under fire. In 2008 alone, some four hundred pieces of plastics-related legislation were introduced at the local, state, and federal levels, including proposed bans on polystyrene fast-food packaging, phthalate-laden toys, and bisphenol A-containing baby bottles, and even one proposal to classify preproduction pellets as hazardous substances. Plastics had never before come under attack on so many different fronts. "We are at the tipping point," SPI president William Carteaux warned thousands of industry members gathered for the group's big annual meeting in 2009. "Legislation and regulation threaten to fundamentally change our business model . . . We can't continue to fight back just at the reactive stage when things are emotionally charged. We have to take the offensive and react quicker." Industrywide, people were realizing it was time to get serious.

Ironically, by focusing their bans on plastic bags alone, anti-bag activists had unintentionally handed the plastics industry one of its most potent weapons. For the inevitable result of banning plastic bags was that grocers would revert to distributing ones made from paper. Consumption of paper bags shot up more than fourfold to eighty-five million annually in San Francisco following the ban. As some environmentalists already knew—and others would quickly learn—this wasn't doing Mother Nature any favors.

"Paper bags are terrible. Terrible!" exclaimed Stephen Joseph, a Bay Area lawyer representing California bag makers in their fight against cities banning plastic bags.

Joseph is an unlikely crusader for plastics. He's a liberal independent who "hates Republicans," an environmentalist who despises litter, and someone with no prior connection to the plastic industry. He's a contrarian by nature and a litigator by training. But Joseph said his true calling is being "a campaigner," a locution that probably reflects his upbringing in England. "I love fighting for a cause," he explained. He may serve as a gun for hire, but, he insisted, only for those causes that he could sincerely endorse.

Now in his fifties, Joseph is an imposing figure with salt-and-pep-

per hair, a high forehead, a long nose, and an irrepressible pugnacious streak. He's enjoyed prior success as a campaigner, most famously when he decided to challenge the food industry's use of trans fats. His stepfather died of a heart attack, and Joseph was shocked to discover that his diet might have been what killed him, so he went on the warpath. His stroke of genius was a 2003 lawsuit to block Kraft Foods from selling Oreo cookies to children on the grounds that they were full of artery-clogging trans fats. The suit generated hostile headlines; Jay Leno and Dave Letterman poked fun at it, and the *Wall Street Journal* called him "the cookie monster." Still, he got the last laugh. Two weeks after Joseph filed suit, Kraft announced it was removing the offending fats. He later ran a successful campaign to make all the restaurants in his hometown of Tiburon trans fat free. Other cities in the country have since followed that lead.

Joseph's success caught the eye of some California bag makers. A man who could win public sympathy with a campaign against Oreo cookies was a man who knew how to champion an unpopular cause. But when they tried to hire him, Joseph turned them down. Then he came across a news article in the London *Times* debunking one of the most commonly cited indictments against plastic bags — that they kill a hundred thousand marine animals a year. As the *Times* discovered, that figure was a misrepresentation of a Canadian study that had implicated discarded fishing nets, not bags, in the deaths of Alaskan seals. "I began digging, thinking if that was a lie, what else was?" Stephens said. The more research he did, the more he became convinced that in the case of plastic vs. paper, plastic was getting an unfair rap. Now he's fighting with a convert's zeal. With his typical in-your-face style, he called his campaign the Save the Plastic Bag Coalition. With atypical reticence, he refused to name the coalition's members.

Joseph can cite chapter and verse from the numerous studies that have shown plastic carries a lesser environmental impact than paper. Life-cycle analyses — studies that analyze a product's cradle-to-grave environmental impact — have consistently found that, compared to paper bags, plastic bags take significantly less energy and water

to produce, require less energy to transport, and emit half as many greenhouse gases in their production. Author Tom Robbins called the paper bag "the only thing civilized man has produced that does not seem out of place in nature," but that's true only if you ignore the tree-felling, chemical-pulping, intensive-bleaching, water-sucking industrial production that goes into making that natural, potato-skin feel of a brown paper bag. In reality, it's no more natural than its crinkly polyethylene counterpart (though it typically will contain more recycled content). If your top environmental concerns are energy conservation and climate change, plastic is unquestionably a greener choice than paper.

However, life-cycle analyses don't tell the whole story. They do best measuring energy-related impacts, but they have trouble with less easily quantified issues, such as litter and marine debris, the toxicity of materials, and impacts on wildlife.

Perhaps more to the point, data-driven comparisons don't speak to our *feelings* about the two materials — our irrational sense of comfort with the feel of paper bags and our sense of discomfort with plastic's preternatural endurance. The presence of plastic where it doesn't belong — matter out of place — pisses people off. This became very apparent when I accompanied Joseph to a 2008 public hearing on a plastic-bag ban proposed by Manhattan Beach, a small, upscale suburb of Los Angeles that's perched on a hill and overlooks a spectacular stretch of ocean. The town is fairly evenly split between Democrats and Republicans, but everyone there cherishes the beaches — there are more surfers per household than just about anywhere else in California.

Joseph and I arrived early. Even though we weren't dressed for the beach — we were both in suits and carting luggage — Joseph suggested we stroll down to check it out. "Do you see any bags?" he kept asking as we walked along. And he was right — most of the litter we saw consisted of cigarette butts, soda cans, and paper trash. "Gorgeous, isn't it . . . Where are the bags?" Joseph said, staring out over the neatly raked stretch of white sand, either ignoring the fact or unaware that county trucks rake the beaches clean of debris every day.

Like other defenders of plastic bags, Joseph maintained that bag litter wasn't a product problem but a behavioral one: bags don't litter; people do. And as such, he insisted, it made no sense to attack the product for the way it was misused. He pointed to two pizza boxes scrunched up on the sidewalk. "Are we going to ban pizza now?"

Yet Joseph's arguments got no traction in the standing-room-only council meeting that night. No one cared if plastic bags were less pernicious for marine life than abandoned nets or that making them produced fewer greenhouse gases than making paper bags, or that city staff had not thoroughly analyzed the environmental impacts of shifting to paper bags. As one activist testified, "This isn't about global warming. It's about the Santa Monica Bay." Supporters of the measure had two priorities: protecting the area's precious coastline and moving the city away from the use of disposable bags of any kind. Council members said they were starting with plastic bags but hoped eventually to take on paper bags as well. "This is not about the transition from plastic to paper. It's about the transition from plastic and paper to reusable bags," said one. "Changing human behavior takes time."

Every member of the council favored the ban. The minute the last vote was recorded, Joseph turned to me and said, "Lawsuit!"

The fact that paper bags would become the default choice in the city's stores gave Joseph solid grounds for that lawsuit and a winning case in court. He argued — and both a trial court and an appeals court have agreed — that the ban violated a state law that requires cities to prepare a study of the possible adverse environmental consequences of proposed laws. That a pro-environmental regulation could be used to defeat a law aimed at protecting the environment was, one commentator suggested, the legal equivalent of "karma's a bitch."

Throughout California, such lawsuits, or threats of lawsuits, slowed the local drives to outlaw plastic bags, forcing at least a dozen cities — including Oakland, Los Angeles, and San Jose — to back off ban proposals and even withdraw enacted laws. The \$50,000 to \$250,000 required to prepare a full environmental-impact report is a high barrier for cash-strapped California municipalities. But eventu-

ally a group of cities decided to pitch in and pay for a report they all could share. When it was completed, in early 2010, it confirmed what Joseph had been saying all along: paper bags carry many more severe environmental impacts than plastic.

That finding was surprising to some plastic-bag-ban advocates, including Carol Misseldine, director of Green Cities California, the group that commissioned the report. It didn't temper her distaste for plastic bags, but it drove home how the political debate had gone off track: the issue isn't really plastic or paper, she said, but the habit of carrying groceries and other merchandise home in bags designed to be used just one time. "Single-use products have extraordinary environmental impacts in manufacturing, processing, and disposal," she said. "We have to get back to a mindset that relies on durable products."

Roger Bernstein of the American Chemistry Council has understood that all along. He recognizes that the plastic-versus-paper fights are sideshows; the real threat to the industry is the battle against single-use products, the drive to replace disposables with reusables. The push for bans and fees are being driven by "a pure expression of the zero-waste ethic, and total non-choice about reusable bags is the end game," he said disdainfully. "Everything needs to be reused!" Bernstein is vice president for state and legislative affairs for the ACC, which has increasingly taken on the role of chief lobbyist for the plastic bag. I met with him and other ACC representatives at their headquarters in Arlington, Virginia, shortly before the group moved to a new state-of-the-art-green, LEED-certified building closer to Capitol Hill.

Bernstein, in his sixties, is a slight, sharp-featured man with a thick thatch of gray hair and brown eyes magnified behind his glasses. He's been a backroom warrior for the industry for more than thirty years. A former journalist, he started at the Society of the Plastics Industry, then moved to the American Plastics Council, a group formed by major resin makers in the late 1980s, and then joined the ACC when it merged with the Plastics Council in 2000. The ACC had kept its

distance from the bag battle, but it took up the fight in early 2008 when the bag makers became overwhelmed by the blizzard of anti-bag measures. The ACC clearly hoped to prevent the furor over bags from snowballing into broader anti-plastics initiatives.

Bernstein divides the politics of plastic into “fear issues” and “guilt issues.” Fear issues, he said, are the ones concerned with “environmental self-protection” or with safety questions such as the debate over the potential health risks of bisphenol A. “You have to address those with all the information you can bring to bear on [the chemical’s] safety,” ideally from third-party sources that will be considered more credible than the industry itself. To that end, the industry has sponsored research studies on suspect chemicals, studies that have a striking tendency to produce results showing the chemicals in question are safe far more often than those conducted by independent researchers do. Bernstein called it delivering information; critics called it sowing doubt.

Plastic bags don’t arouse fear, but, as Bernstein recognized, they do play on people’s sense of guilt about consumption and the wastefulness of throwaway products. The answer to that is to give people ways to feel all right about single-use plastic products. That means public relations campaigns to remind people about the benefits of plastics and industry-sponsored bills and programs that promote recycling, which he called “a guilt eraser.” Recycling assures people that plastic isn’t just an infernal hanger-on; it has a useful afterlife. “As soon as they recycle your product,” he explained, “they feel better about it.” Then they don’t want to ban it.

Bernstein learned the methods of guilt assuagement in the late 1980s during an earlier public outcry over plastics packaging. Fears about shrinking landfill space touched off a wave of calls for bans on Styrofoam takeout containers and other visible forms of plastic trash.

In response, seven of the major resin makers, including DuPont, Dow, Exxon, and Mobil, launched a special initiative—a short-term “strike force,” as Bernstein described it—to ramp up plastics recycling, at that time virtually nonexistent. The group spent some forty million dollars developing plastics-recycling technology and provid-

ing technical help and equipment to communities that wanted to start recycling programs. It was a great boon to recycling, but the commitment was shallow—the support evaporated once the political furor died down.

The heftier and lengthier investment was a \$250 million, decade-long campaign of print and TV ads spotlighting how plastics enhanced people’s health and safety, with heavy emphasis on products such as bike helmets and tamper-proof packaging. The Plastics Make It Possible campaign succeeded in lifting plastics’ favorability ratings, polls showed. People still thought plastics posed serious disposal problems, but they weren’t clamoring for bans anymore.

That was also due to the heavy stick the industry wielded, alongside the proplastics carrots. Aggressive industry lobbying succeeded in defeating or gutting hundreds of restrictive bills. “There were no bans, essentially, in all that time,” Bernstein recalled proudly. Between recycling, PR, and hardball lobbying, “There were no products that were put out of the marketplace.”

The ACC is using that same playbook again. It’s launched a major public relations effort, reaching out especially to the millennium generation with a Facebook page, Mylecule (which as of August 2010 had only seven monthly users), a YouTube channel, a Twitter handle, blogs, and sponsorship of art exhibits and fashion shows where the message is “plastic is the new black.”

Meanwhile, Bernstein is directing the political combat. He’s choosing his battles carefully, focusing on high-profile cities and states to get the most bang for the buck. For instance, the group spent \$5.7 million in California during the 2007 to 2008 legislative sessions, when some of the most intense bag debates were taking place, and nearly one million dollars during the months in 2010 when the legislature was considering a proposed statewide ban. By highlighting the environmental problems of paper bags, the ACC succeeded in steering initiatives aimed at banning plastic bags to either voluntary or mandatory store-based recycling programs in New York, Philadelphia, Chicago, Annapolis, and the state of Rhode Island, among other places.

But more recent fights have required the ACC to address the issue

of reusability directly—a point where the industry can play to people’s mixed feelings about single-use products. In Seattle, for instance, the group waged an aggressive campaign against a 2008 law passed by the city council requiring grocers to charge twenty cents each for either plastic or paper bags—the same approach San Francisco originally wanted to take. Left standing, the law would have marked the biggest victory to date for advocates of reusability. You’d think an ecotopia like Seattle—where the public utilities use goats instead of pesticides to keep down weeds—would be an unlikely place for a plastics showdown. Yet Bernstein and his colleagues realized they had a shot at winning when they got a look at polling conducted by the city. The polls showed that most Seattleites were willing to accept a ban on plastic bags. At the same time, they were unwilling to pay a fee for them at the grocery store. They could live without plastic bags, but not without the convenience of a free one-time-use tote for their groceries. That ambivalence—certainly not limited to Seattleites—offered the ACC an opening.

The group spent more than \$180,000 on a successful drive to gather signatures for a ballot initiative to overturn the fee, and then another \$1.4 million on the election—the most spent in the city on any election in at least fifteen years. Using the same PR firm that crafted the famous Harry and Louise ads that defeated the Clinton-era health-care reform initiative, the group developed an ad campaign that recast the fee (which citizens could avoid by not buying bags) as a regressive mandatory tax, as in the following radio ad:

Man: You heard there might be a tax on grocery bags, on paper and plastic bags, right?

Woman: Another tax in this economy? . . . But most of us already reuse or recycle these bags.

The campaign maintained that the fee would cost each consumer three hundred dollars a year, which assumed each consumer was buying fifteen hundred bags a year—or twenty-eight bags a week. Whether or not an individual really would purchase so many bags, it

was a powerful argument in the midst of the Great Recession, and one that was difficult to counter. There’s no easy catch phrase to articulate the logic of making hidden environmental costs visible. What’s more, advocates of the fees—groups such as the Sierra Club and the People for Puget Sound—raised just a fraction of the ACC’s war chest, leaving them outspent by a margin of fourteen to one. By the time the election took place, no one was surprised when voters rejected the fee.

The ACC followed a similar strategy the next year in California when state lawmakers proposed restricting all single-use grocery bags. The measure was designed to steer Californians toward reusables by banning plastic bags and requiring grocers to charge at least a nickel for paper bags. Given California’s political influence, the ACC, and member companies ExxonMobil and Hilex Poly, pulled out all stops to defeat the measure, together spending more than two million dollars on efforts that included peppering the statehouse with donations to key legislators and blitzing Sacramento (where lawmakers lived) with newspaper and radio ads decrying the fee as a regressive tax that would cost Californians more than a billion dollars a year. (The ACC even attacked reusable bags by funding and publicizing research that showed the bags could be a breeding ground for food-borne bacteria.) “Instead of wasting time and telling us how to bag our groceries, lawmakers should be working on our real problems, including a huge budget deficit, home foreclosures, and millions of workers without jobs,” the ACC argued on a website that called for voters to “Stop the Bag Police.” The arguments may have been beside the point, but even proponents of the ban admired how shrewdly they played to the state’s political climate. They made the concern with bags seem silly, as if it were “one of those nanny-government type issues,” said Murray. At a time when California was \$19 billion in the red and the fractious state legislature was months late in approving a budget, no lawmaker wanted to be seen as a person who banned bags but couldn’t manage to organize the state’s finances. In the end, the state senate killed the bill, twenty-one to fourteen.

Still, the unprecedented breadth of the coalition that supported the proposed ban—environmental groups, recycling groups, unions,

the state's grocers and retailers, and even Schwarzenegger — suggests that the bag's days in California are numbered. Indeed, Murray and other strategists simply shifted their focus, taking the issue, as he said, "back to the locals." In the following months, a number of cities, including San Jose, Los Angeles, and Santa Monica, began moving ahead with plans to restrict T-shirt bags. And unlike the earlier generation of anti-bag measures, these aim to restrict paper bags as well.

California has long been a bellwether state — pioneering the trends that the rest of the country later follows. It's hard to know if that will prove the case with plastic bags, whether the marine debris and waste issues that resonate so strongly in California politics will have the same effect elsewhere in the country. The ACC may have succeeded in squelching most the proposals for bans, but its intense lobbying failed to stop the District of Columbia city council from passing a five-cent charge on plastic bags, the proceeds of which will be used to fund a cleanup of the district's litter-choked Anacostia River. The 2009 measure was promoted with slogans like "Skip the Bag, Save the River." Residents grumbled about it at first, but after nearly a year, according to city officials, consumers and shop owners have come to accept it and are using notably fewer plastic bags. The D.C. experience suggests that people are willing to pay the price of convenience when its true costs are made clear.

Along with the political combat, the ACC continues to push that time-tested guilt eraser — recycling. It has spearheaded a variety of initiatives to spur recycling of plastic bags, from purchasing hundreds of recycling bins to place on California beaches to backing store-based programs. On Earth Day 2009, the ACC announced a more significant commitment: an initiative to manufacture plastic bags with the same proportion of recycled content that paper bags have long contained. Until now, that kind of bag-to-bag recycling has not been widely pursued, since new bags are so cheap to make. The small percentage of bags that are recycled generally go into producing plastic lumber, often used in decking and fences. But the ACC promised that through this new program, bag makers would spend millions to retool their equipment; by 2015, 40 percent of the plastic

in T-shirt bags would come from recycled bags. The program would recycle upward of 470 million pounds of plastic, the ACC estimated.

"It is a little too little, a little too late" was Mark Murray's reaction. For even if the initiative fully succeeded, it would recycle only thirty-six billion bags — a mere third of all the bags Americans currently consume every year. Murray and other critics have long maintained that T-shirt bags simply don't lend themselves to the practical and economic requirements of recycling. They're so nearly weightless that it's difficult to gather enough of a critical mass to make recycling them economically worthwhile. Collecting them through curbside programs is tough because the bags are so flight-prone, and the store-based collection programs pushed by the ACC have scarcely raised bag recycling above single-digit rates.

Obviously, it's better for bags to be recycled than thrown away. But the practicalities of bag recycling are largely beside the point. The ACC needs recycling programs to assuage people's guilt about using plastic bags. If we can be persuaded that plastics have a lifetime beyond a one-time shopping trip, then maybe we won't bother to think about the wasted resources the bag literally and figuratively embodies. Thus the new message ACC spokespeople now repeat endlessly whenever called upon to defend plastic bags (or any other single-use plastic product): "Plastic is a valuable resource. Too valuable to waste."

Surely it's no coincidence that this is just the sort of phrase zero-waste advocates use when explaining why they are attacking the plastic bag. To San Francisco's Robert Haley, the bag is the ultimate example of waste, a diversion of valuable nonrenewable resources into an ephemeral product of marginal value. "Plastic should be a high value material," Haley said. "It should be in products that last a long time, and at the end of the life, you recycle it. To take oil or natural gas that took millions of years to produce and then to make a disposable product that lasts minutes or seconds, and then to just discard it — I think that's not a good way of using this resource."

The absurdity of the plastic-bag controversy becomes clear when you consider that people carried things for millennia without the aid

of plastic or paper bags. (Be grateful we've passed the era when a bull's scrotum was the bag of choice.) Happily, we don't have to reach that far back to find the bag of the future. A reusable shopping bag can be made of any material — cotton, jute, polyester, nylon, polypropylene mesh, recycled soda bottles, or even thick durable polyethylene. Whatever the material, it will be an improvement over today's giveaways, provided it is frequently reused.

Not all single-use products are so easily replaced. But the fact that the plastic bag can be readily swapped for a sustainable alternative is one reason activists like Murray have put so much effort into the bag wars. That choice at the checkout stand marks an important first step in getting people to think about the environmental consequences of their actions, Murray said. "If you can get people to take this action of bringing their own bags to the store, that's an environmental statement that they're making in their lives," he said. "It's a gateway to environmental activity that I think will spread to other things that they might be willing to do."

As anyone who has tried to quit smoking or follow a diet or commit to a workout routine can attest, it's not easy to change our patterns of behavior, to do things we know, in the abstract, are good for us. So how *do* you encourage people to change their ways, to cultivate habits that are healthier for the environment? Arizona State University psychologist Robert Cialdini has done research for many years on the most effective ways to nudge people toward more environmentally responsible behavior. Surprisingly, the best method isn't to ask people to look inside themselves; rather, ask them to look *outward*, to their peers. "You simply inform them of what the social norm is," said Cialdini. It's not that people don't know littering is wrong or that one should turn off lights when leaving a room. But people forget, grow careless, and need to be reminded, said Cialdini. In one study, he found that the best way to encourage hotel guests to reuse their towels was to leave a card in the room telling them that's what other guests did. That statement had more impact than did cards that told guests they should reuse their towels because it would help the

environment, or save energy, or allow the hotel to save money and therefore charge less for its rooms. Another example: Cialdini helped craft a public service announcement designed to encourage Arizona residents to recycle. The PSA said, in essence, Arizonans approve of people who recycle and disapprove of those who don't. It declared recycling was the social norm. Most PSAs move only 1 to 2 percent of listeners to action, according to Cialdini. "Those public service announcements produced a hundred and twenty-five percent increase in recycling tonnage. That's unheard-of."

The frustrating thing about watching the bag wars over the past three years has been seeing how politics reaches for the easy answers, using policies that aren't very effective in making people change the way they think. Fees and public education campaigns help nurture a shared social value of reuse. By contrast, bans may capitalize on and reinforce people's reflexive distaste for plastics without encouraging them to question their reliance on single-use bags of any sort. At least that seems to be the experience in my hometown of San Francisco.

An independent consultant who visited all fifty-four of the city's major grocery stores in 2008 found they all were dispensing paper bags, and in many instances double-bagging whether or not it was needed. True, paper bags may be easily recycled or composted, but San Franciscans are still consuming tens of millions of shopping bags designed for a single trip home from the grocery store. And despite the ban, the city is still awash in plastic bags, since the ban applied only to big groceries and drugstores. Mom-and-pop stores still hand out T-shirt bags, as do produce markets, takeout restaurants, clothing stores, hardware stores, and a host of other retailers. And every morning, rain or shine, my newspapers still arrive in tubular plastic sacks, often double-bagged. I've taken home relatively few plastic bags in over three years, and yet those two bag holders in my broom closet are always overflowing.

For all the shortcomings of bans, they have sustained a public discourse about our single-use habits. And there are hopeful signs that the throwaway mindset is changing. Makers of reusable bags report huge increases in sales; one Phoenix company that makes polypro-

polyene mesh bags saw sales jump 1,000 percent in 2008. ChicoBag, a California company, saw sales of its five-dollar polyester bag triple that year and they have continued to grow. Meanwhile, some makers of plastic bags see a new market opportunity and are retooling to produce heavier-gauge polyethylene bags that are truly reusable.

Recently, I spent one day doing an admittedly unscientific survey at three different grocery stores in San Francisco. While most shoppers were wheeling out carts stacked with paper bags, a small number, maybe two in ten, had their groceries packed in reusable bags—battered canvas bags, heavy plastic totes, or the mesh polypropylene bags that all the major stores in town are now selling for a dollar. Nearly every person in this robust minority said he or she had switched over to reusable bags in the past year or so. I stopped one young woman with five bags in her cart. She said she began bringing her own bags about a year before “just to be environmentally friendly.” The reusable bags in her cart looked so new and pristine I asked whether she owned a lot of them. “No,” she answered. “I have, like, five, and I always keep them in my trunk. I try not to waste them either.”



Closing the Loop

NATHANIEL WYETH OFTEN called himself “the other Wyeth” in deference to his famous artist family: his father, N. C. Wyeth, and siblings Andrew and Henriette. It was clear from an early age that he wouldn’t be joining that artistic dynasty. Instead of inks and paints, he was fascinated by gears and gadgets—so much so that when he was ten, his father changed the boy’s first name from Newell (his own given name) to Nathaniel, after an uncle who was an engineer. Sure enough, Wyeth went on to train as a mechanical engineer and in 1936 joined DuPont, where he remained for nearly forty years, inventing up a storm in plastics as well as in other materials. It irritated him that chemistry didn’t get the same creative kudos as art. A painter need only imagine a picture and then put it to canvas, he pointed out, while a polymer engineer had to conjure entirely new molecules, give them substance, and make them work. As he once told an interviewer, “I’m in the same field as the artists—creativity—but theirs is a glamour one.”

The act of imagination that won him a spot in the Plastics Hall of Fame began one day in 1967 with a question: Why does soda come only in glass bottles? Coworkers explained that plastic bottles ex-

INTRODUCTION

Plasticville

IN 1950, a Philadelphia toy company came out with a new accessory for electric-train enthusiasts: snap-together kits of plastic buildings for a place it called Plasticville, U.S.A. Sets of plastic people to populate the town were optional.

It started as a sleepy, rural place where trains might roll past red-sided barns to pull into a village with snug Cape Cod homes, a police department, a fire station, a schoolhouse, and a quaint white church with a steeple. But over the years, the product line spread into a bustling burb of housing tracts filled with two-story Colonials and split-level ranch houses and a Main Street that boasted a bank, a combination hardware store/pharmacy, a modern supermarket, a two-story hospital, and a town hall modeled on Philadelphia's historic Independence Hall. Eventually Plasticville even gained a drive-in motel, an airport, and its own TV station, WPLA.

Today, of course, we all live in Plasticville. But it wasn't clear to me just how plastic my world had become until I decided to go an entire day without touching anything plastic. The absurdity of this experiment became apparent about ten seconds into the appointed morning when I shuffled bleary-eyed into the bathroom: the toilet seat

was plastic. I quickly revised my plan. I would spend the day writing down everything I touched that was plastic.

Within forty-five minutes I had filled an entire page in my Penway Composition Book (which itself had to be cataloged as partly plastic, given its synthetic binding, as did my well-sharpened no. 2 pencil, which was coated with yellow paint that contained acrylic). Here's some of what I wrote down as I made my way through my early-morning routine:

Alarm clock, mattress, heating pad, eyeglasses, toilet seat, toothbrush, toothpaste tube and cap, wallpaper, Corian counter, light switch, tablecloth, Cuisinart, electric teakettle, refrigerator handle, bag of frozen strawberries, scissors handle, yogurt container, lid for can of honey, juice pitcher, milk bottle, seltzer bottle, lid of cinnamon jar, bread bag, cellophane wrapping of box of tea, packaging of tea bag, thermos, spatula handle, bottle of dish soap, bowl, cutting board, baggies, computer, fleece sweatshirt, sports bra, yoga pants, sneakers, tub containing cat food, cup inside tub to scoop out the kibble, dog leash, Walkman, newspaper bag, stray packet of mayo on sidewalk, garbage can.

"Wow!" said my daughter, her eyes widening as she scanned the rapidly growing list.

By the end of the day I had filled four pages in my notebook. My rule was to record each item just once, even those I touched repeatedly, like the fridge handle. Otherwise I could have filled the whole notebook. As it was, the list included 196 entries, ranging from large items, like the dashboard of my minivan—really, the entire interior—to minutiae, like the oval stickers adorning the apples I cut up for lunch. Packaging, not surprisingly, made up a big part of the list.

I'd never thought of myself as having a particularly plastic-filled life. I live in a house that's nearly a hundred years old. I like natural fabrics, old furniture, food cooked from scratch. I would have said my home harbors less plastic than the average American's—mainly for aesthetic reasons, not political ones. Was I kidding myself? The

next day I tracked everything I touched that *wasn't* made of plastic. By bedtime, I had recorded 102 items in my notebook, giving me a plastic/nonplastic ratio of nearly two to one. Here's a sample from the first hour of the day:

Cotton sheets, wood floor, toilet paper, porcelain tap, strawberries, mango, granite-tile countertop, stainless steel spoon, stainless steel faucet, paper towel, cardboard egg carton, eggs, orange juice, aluminum pie plate, wool rug, glass butter dish, butter, cast-iron grid-dle, syrup bottle, wooden breadboard, bread, aluminum colander, ceramic plates, glasses, glass doorknob, cotton socks, wooden dining-room table, my dog's metal choke collar, dirt, leaves, twigs, sticks, grass (and if I weren't using a plastic bag, what my dog deposited amid those leaves, twigs, and grass).

Oddly, I found it harder and more boring to maintain the nonplastic list. Because I'd pledged not to count items more than once, after the first flood of entries, there wasn't that much variety—at least not when compared with the plastics catalog. Wood, wool, cotton, glass, stone, metal, food. Distilled further: animal, vegetable, mineral. Those basic categories pretty much encompassed the items on the nonplastic list. The plastic list, by contrast, reflected a cornucopia of materials, a dazzling variety of the synthetica that has come to constitute such a huge, and yet strangely invisible, part of modern life.

Pondering the lengthy list of plastic in my surroundings, I realized I actually knew almost nothing about it. What is plastic, really? Where does it come from? How did my life become so permeated by synthetics without my even trying? Looking over the list I could see plastic products that I appreciated for making my life easier and more convenient (my wash-and-wear clothes, my appliances, that plastic bag for my dog's poop) and plastic things I knew I could just as easily do without (Styrofoam cups, sandwich baggies, my nonstick pan).

I'd never really looked hard at life in Plasticville. But news reports about toxic toys and baby bottles seemed to suggest that the costs might outweigh the benefits. I began to wonder if I'd unwittingly ex-

posed my own children to chemicals that could affect their development and health. That hard-plastic water bottle I'd included in my daughter's lunch since kindergarten has been shown to leach a chemical that mimics estrogen. Was that why she'd sprouted breast buds at nine? Other questions quickly followed. What was happening to the plastic things I diligently dropped into my recycling bin? Were they actually being recycled? Or were my discards ending up far away in the ocean in vast currents of plastic trash? Were there seals somewhere choking on my plastic bottle tops? Should I quit using plastic shopping bags? Would that soda bottle really outlive my children and me? Did it matter? Should I care? What does it really mean to live in Plasticville?

The word *plastic* is itself cause for confusion. We use it in the singular, and indiscriminately, to refer to any artificial material. But there are tens of thousands of different plastics.* And rather than making up a single family of materials, they're more a collection of loosely related clans.

I got a glimpse of the nearly inexhaustible possibilities contained in that one little word when I visited a place in New York called Material ConneXion, a combination of a consultancy and a materials larder for designers pondering what to make their products out of. Its founder described it as a "petting zoo for new materials." And I did feel like I was in a tactile and visual wonderland as I browsed some of the thousands of plastics on file. There was a thick acrylic slab that looked like a pristine frozen waterfall; jewel-colored blobs of gel that begged to be squeezed; a flesh-toned fabric that looked and felt like an old person's skin. ("Ugh, I'd never want to wear anything like that," one staffer commented.) There were swatches of fake fur, green netting, gray shag rug, fake blades of grass, fabric that holds the memory of how it's folded, fabric that can absorb solar energy and transmit it to the wearer. I looked at blocks that mimicked finely

* For a brief description of the more common plastics, see "Cast of Characters" at the end of the book.

veined marble, smoky topaz, dull concrete, speckled granite, grained wood. I touched surfaces that were matte, shiny, bumpy, sandpapery, fuzzy, squishy, feathery, cool as metal, warm and yielding as flesh.

But a plastic doesn't have to be part of the exotic menagerie at Material ConneXion to impress. Even a common plastic such as nylon offers wow-inducing possibility. It can be silky when serving in a parachute, stretchy when spun into pantyhose, bristly when fixed at the end of your toothbrush, or bushy on a strip of Velcro. *House Beautiful* swooned over such versatility in a 1947 article titled "Nylon . . . the Gay Deceiver."

However much they differ, all plastics have one thing in common: they are polymers, which is Greek for "many parts." They are substances made up of long chains of thousands of atomic units called monomers (Greek for "one part") linked into giant molecules. Polymer molecules are absurdly huge compared to the tidy, compact molecules of a substance like water, with its paltry one oxygen and two hydrogen atoms. Polymer molecules can contain tens of thousands of monomers—chain links so long that for years scientists disputed whether they could actually be bonded into a single molecule. You might as well claim, said one chemist, that "somewhere in Africa an elephant was found who was 1,500 feet long and 300 feet high." But the molecules did exist, and their hugeness helps account for plastic's essential feature: its plasticity. Think of the ways a long strand of beads can be manipulated—pulled or stretched, stacked or coiled—compared to what can be done with just a single bead or a few. The lengths and arrangement of the strands help to determine a polymer's properties: its strength, durability, clarity, flexibility, elasticity. Chains crowded close together can make for a tough, rigid plastic bottle, like the kind used to hold detergent. Chains more widely spaced can yield a more flexible bottle ideal for squeezing out ketchup.

It's often said that we live in the age of plastics. But when, exactly, did we slip into that epoch? Some say it began in the mid-nineteenth century, when inventors started developing new, malleable semi-

synthetic compounds from plants to replace scarce natural materials such as ivory. Others fix the date to 1907, when Belgian émigré Leo Baekeland cooked up Bakelite, the first fully synthetic polymer, made entirely of molecules that couldn't be found in nature. With the product's invention, the Bakelite Corporation boasted, humans had transcended the classic taxonomies of the natural world: the animal, mineral, and vegetable kingdoms. Now we had "a fourth kingdom, whose boundaries are unlimited."

You could also peg the dawn of the plastics age to 1941, when, shortly after the bombing of Pearl Harbor, the director of the board responsible for provisioning the American military advocated the substitution, whenever possible, of plastics for aluminum, brass, and other strategic metals. World War II pulled polymer chemistry out of the lab and into real life. Many of the major plastics we know today — polyethylene, nylon, acrylic, Styrofoam — got their first marching orders during the war. And having ramped up production to meet military needs, industry inevitably had to turn its synthetic swords into plastic plowshares. As one early plastics executive recalled, by the war's end it was obvious that "virtually nothing was made from plastic and anything could be." That's when plastics truly began infiltrating every pore of daily life, quietly entering our homes, our cars, our clothes, our playthings, our workplaces, even our bodies.

In product after product, market after market, plastics challenged traditional materials and won, taking the place of steel in cars, paper and glass in packaging, and wood in furniture. Even Amish buggies are now made partly out of the fiber-reinforced plastic known as fiberglass. By 1979, production of plastics exceeded that of steel. In an astonishingly brief period, plastic had become the skeleton, the connective tissue, and the slippery skin of modern life.

Indisputably, plastic does offer advantages over natural materials. Yet that doesn't fully account for its sudden ubiquity. Plasticville became possible — and perhaps even inevitable — with the rise of the petrochemical industry, the behemoth that came into being in the 1920s and '30s when chemical companies innovating new polymers

began to align with the petroleum companies that controlled the essential ingredients for building those polymers.

Oil refineries run 24-7 and are continuously generating byproducts that must be disposed of, such as ethylene gas. Find a use for that gas, and your byproduct becomes a potential economic opportunity. Ethylene gas, as British chemists discovered in the early 1930s, can be made into the polymer polyethylene, which is now widely used in packaging. Another byproduct, propylene, can be redeployed as a feedstock for polypropylene, a plastic used in yogurt cups, microwavable dishes, disposable diapers, and cars. Still another is the chemical acrylonitrile, which can be made into acrylic fiber, making possible that quintessential emblem of our synthetic age AstroTurf.

Plastics are a small piece of the petroleum industry, representing a minor fraction of the fossil fuels we consume. But the economic imperatives of the petroleum industry have powered the rise of Plasticville. As environmentalist Barry Commoner argued: "By its own internal logic, each new petrochemical process generates a powerful tendency to proliferate further products and displace pre-existing ones." The continuous flow of oil fueled not just cars but an entire culture based on the consumption of new products made of plastics. This move into Plasticville wasn't a considered decision, the result of some great economic crisis or political debate. Neither did it take into account social good or environmental impact or what we were supposed to do with all our plastic things at the end of their useful lives. Plastic promised abundance on the cheap, and when in human history has that ever been a bad thing? No wonder we became addicted to plastic, or, rather, to the convenience and comfort, safety and security, fun and frivolity that plastic brought.

The amount of plastic the world consumes annually has steadily risen over the past seventy years, from almost nil in 1940 to closing in on six hundred billion pounds today. We became plastic people really just in the space of a single generation. In 1960, the average American consumed about thirty pounds of plastic products. Today, we're each consuming more than three hundred pounds of plastics a year, gen-

erating more than three hundred billion dollars in sales. Considering that lightning-quick ascension, one industry expert declared plastics “one of the greatest business stories of the twentieth century.”

The rapid proliferation of plastics, the utter pervasiveness of it in our lives, suggests a deep and enduring relationship. But our feelings toward plastic are a complicated mix of dependence and distrust — akin to what an addict feels toward his or her substance of choice. Initially, we reveled in the seeming feats of alchemy by which scientists produced one miraculous material after another out of little more than carbon and water and air. It’s “wonderful how du Pont is improving on nature,” one woman gushed after visiting the company’s Wonder World of Chemistry exhibit at a 1936 Texas fair. A few years later, people told pollsters they considered *cellophane* the third most beautiful word in the English language, right behind *mother* and *memory*. We were prepared, in our infatuation, to believe only the very best of our partner in modernity. Plastics heralded a new era of material freedom, liberation from nature’s stinginess. In the plastic age, raw materials would not be in short supply or constrained by their innate properties, such as the rigidity of wood or the reactivity of metal. Synthetics could substitute for, or even precisely imitate, scarce and precious materials. Plastic, admirers predicted, would deliver us into a cleaner, brighter world in which all would enjoy a “universal state of democratic luxury.”

It’s hard to say when the polymer rapture began to fade, but it was gone by 1967 when the film *The Graduate* came out. Somewhere along the line — aided surely by a flood of products such as pink flamingos, vinyl siding, Corfam shoes — plastic’s penchant for inexpensive imitation came to be seen as cheap ersatz. So audiences knew exactly why Benjamin Braddock was so repelled when a family friend took him aside for some helpful career advice: “I just want to say one word to you . . . Plastics!” The word no longer conjured an enticing horizon of possibility but rather a bland, airless future, as phony as Mrs. Robinson’s smile.

Today, few other materials we rely on carry such a negative set of

associations or stir such visceral disgust. Norman Mailer called it “a malign force loose in the universe . . . the social equivalent of cancer.” We may have created plastic, but in some fundamental way it remains essentially alien — ever seen as somehow unnatural (though it’s really no less natural than concrete, paper, steel, or any other manufactured material). One reason may have to do with its preternatural endurance. Unlike traditional materials, plastic won’t dissolve or rust or break down — at least, not in any useful time frame. Those long polymer chains are built to last, which means that much of the plastic we’ve produced is with us still — as litter, detritus on the ocean floor, and layers of landfill. Humans could disappear from the earth tomorrow, but many of the plastics we’ve made will last for centuries.

This book traces the arc of our relationship with plastics, from enraptured embrace to deep disenchantment to the present-day mix of apathy and confusion. It’s played out across the most transformative century in humankind’s long project to shape the material world to its own ends. The story’s canvas is huge but also astonishingly familiar, because it is full of objects we use every day. I have chosen eight to help me tell the story of plastic: the comb, the chair, the Frisbee, the IV bag, the disposable lighter, the grocery bag, the soda bottle, the credit card. Each offers an object lesson on what it means to live in Plasticville, enmeshed in a web of materials that are rightly considered both the miracle and the menace of modern life. Through these objects I examine the history and culture of plastics and how plastic things are made. I look at the politics of plastics and how synthetics are affecting our health and the environment, and I explore efforts to develop more sustainable ways of producing and disposing of plastics. Each object opens a window onto one of Plasticville’s many precincts. It is my hope that taken together, they shed light on our relationship with plastic and suggest how, with effort, it might become a healthier one.

Why did I decide to focus on such small, common things? None have the razzle-dazzle that cutting-edge polymer science is delivering, such as smart plastics that can mend themselves and plastics

that conduct electricity. But those are not the plastic things that play meaningful roles in our everyday lives. I also chose not to use any durable goods, such as cars or appliances or electronics. No question any of these could have offered insights into the age of plastics. But the material story of a car or an iPhone encompasses far more than just plastics. Simple objects, properly engaged, distill issues to their essence. As historian Robert Friedel notes, it's in the small things "that our material world is made."

Simple objects sometimes tell tangled stories, and the story of plastics is riddled with paradoxes. We enjoy an unprecedented level of material abundance and yet it often feels impoverishing, like digging through a box packed with Styrofoam peanuts and finding nothing else there. We take natural substances created over millions of years, fashion them into products designed for a few minutes' use, and then return them to the planet as litter that we've engineered to never go away. We enjoy plastics-based technologies that can save lives as never before but that also pose insidious threats to human health. We bury in landfills the same kinds of energy-rich molecules that we've scoured the far reaches of the earth to find and excavate. We send plastic waste overseas to become the raw materials for finished products that are sold back to us. We're embroiled in pitched political fights in which plastic's sharpest critics and staunchest defenders make the same case: these materials are too valuable to waste.

These paradoxes contribute to our growing anguish over plastics. Yet I was surprised to discover how many of the plastics-related issues that dominate headlines today had surfaced in earlier decades. Studies that show traces of plastics in human tissue go back to the 1950s. The first report of plastic trash in the ocean was made in the 1960s. Suffolk County, New York, enacted the first ban on plastic packaging in 1988. In every case, the issues seized our attention for a few months or even years and then slipped off the public radar.

But the stakes are much higher now. We've produced nearly as much plastic in the first decade of this millennium as we did in the entire twentieth century. As Plasticville sprawls farther across the landscape, we become more thoroughly entrenched in the way of

life it imposes. It is increasingly difficult to believe that this pace of plasticization is sustainable, that the natural world can long endure our ceaseless "improving on nature." But can we start engaging in the problems plastics pose? Is it possible to enter into a relationship with these materials that is safer for us and more sustainable for our offspring? Is there a future for Plasticville?