

SEX, BOMBS AND BURGERS

How War, Porn
and Fast Food
Created Technology
As We Know It

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ALLEN & UNWIN

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We are living now, not in the delicious intoxication induced by the early successes of science, but in a rather grisly morning-after, when it has become apparent that what triumphant science has done hitherto is to improve the means for achieving unimproved or actually deteriorated ends.¹

—ALDOUS HUXLEY

The inspiration for this book came from the unlikeliest of sources: Paris Hilton. I wish it was some deeper or more sophisticated source, like the many scientific journals I've read, a PBS documentary I'd seen or even *Wired* magazine, but nope. My muse, I'm ashamed to admit, was a hotel heiress with no discernible talents.

It was 2004, at the very beginning of the young blonde's meteoric rise to celebrity. The internet was aflutter with a video of Hilton, then twenty-three, having sex with her boyfriend, fellow socialite Rick Salomon. There was, as is usually the case with celebrity sex tapes, a debate over whether the video had been purposely leaked to raise Hilton's public profile. Regardless, it certainly succeeded in getting attention. The video intrigued me, not because of the sex or the celebrity-to-be, but because a good portion of it was green. The naked flesh on display was not a rosy pink, but rather monochromatic hues of emerald. This was, I realized, because the video had been shot in the dark using the camera's night-vision mode. While most viewers marvelled at Paris's, er, skills, I was interested in the technology being used behind the scenes. Welcome to the life of a nerd.

As a technology journalist, I'm used to wondering what's under the hood, so to speak, and thinking about such cultural events in ways the non-technically minded, thankfully, never consider. When CNN trotted out the world's first televised "holograms" during the 2008 American presidential election and compared them to R2-D2's projection of Princess Leia in the first *Star Wars* movie, alarm bells rang and led me to discover that they were in fact "tomograms"—three-dimensional images beamed onto the viewer's screen and not into the thin air of CNN's studio. Similarly, most people enjoy Lego toys for their simplicity. Me? I couldn't help but wonder how designers decided on the optimum number, shape and variety of pieces in each set. So I called them to find out. It turns out that there are a lucky group of Lego employees who test-build sets, using three-dimensional modelling software to create new pieces as they are needed. The software also prices the sets based on the number of parts, so designers can add or subtract pieces to get the kit to their target cost.

Such are my nerdy preoccupations; these are the stories I write in my daily life as a journalist.

I knew I had seen Paris Hilton's night-vision technology before. The notion nagged at me for days before it finally hit: the first Gulf War, also known as Operation Desert Storm. More than a decade earlier, a coalition of countries led by the United States had gone to war to liberate Kuwait from a brash takeover by Saddam Hussein's Iraq. I was too young for the televised reports of the Vietnam War so Desert Storm was the first big military action I had seen, played out on CNN as it was. The images that defined the war for me were the nighttime bombing raids—the barrage of anti-aircraft fire arcing upward, followed by huge explosions

on the ground. Like the sex video, the most memorable images of Iraq's defeat were, for me, bathed in green.

It got me wondering what other consumer technologies are derived from the military. The more I delved into it, the more I found that just about everything is. From plastic bags and hair-spray to vitamins and Google Earth, military money has funded the development of most of the modern items we use today. I also found many other links between war and the technology used in pornography, which is basically what Paris's video was. The porn industry has been quick to adopt every communications medium developed by the military, from smaller film cameras to magnetic recording (which led to VCRs) to lasers (which led to DVDs) to the internet. Porn companies jumped on these technologies well before other commercial industries, thereby providing the money needed to develop them further.

The technological savvy of these two industries should come as no surprise. Lust and the need to fight or compete are two of the most primitive and powerful human instincts. They are our basest needs, a duo of forces that drive many of our key actions. Despite centuries of trying to deny, avoid, cure or otherwise suppress these forces, we have so far failed to find any course of action other than satiating them. As a result, catering to these needs has become big business. And big business needs technology to stay current and competitive.

Of course, there is another powerful urge that drives us: the rumbling in our bellies. At about the same time as Paris was getting famous, I was just starting to read the labels on grocery store shelves. Like anyone entering that phase of life where the metabolism starts to slow down—the tardy thirties, as I like to think of them—I was actually starting to care about what

I ate and therefore becoming concerned about the amount of glucose, fructose, phosphoric acid, sodium hydrogen carbonate and other assorted chemicals I was putting into my body. If you've ever read those labels and come across ingredients you can't pronounce, you've probably realized—as I did—just how much technology goes into our food.

As eye-opening as this was, though, it really shouldn't have come as a surprise. Our need for food is the most elemental instinct of them all, trumping all others, because without food we simply can't survive. It's understandable then that throughout history, we've used every resource at our disposal to ensure we have enough food on hand. Food has always been linked to power, and thereby to conflict. Historically, he who has had the most food has typically had the most power. And the best way to create lots of food is through technology. Ultimately, the more technology you have, the more food you have and the more powerful you are. This doesn't just apply at a macro level, either—in any society, a wealthy individual is a well-fed individual.

Our war-, sex- and food-related instincts go well beyond technology—they influenced human evolution itself. A recently unearthed hominid skeleton—4.4 million years old, the oldest discovered thus far—has presented evidence that war, sex and food were the three factors that led to humans getting up off all fours to become bipedal. Researchers at Kent State University in Ohio believe that early human males competed for female attentions by fighting it out. As with most apes, the ones who ended up with a mate were always the strongest and fiercest. Lesser males, however, also succeeded in getting female attention, but they used a different tactic—they brought them

gifts. At the dawn of humanity, there was of course only one gift that mattered: food. Researchers have postulated that these lesser males had to learn how to walk on two feet in order to free up their hands so that they could carry this food to the females.

Millions of years later, little has changed. People still fight for food and sex, and we still use food (and other gifts) to try to get sex. These hard-wired, intersecting instincts have, over time, become our obsessions. Open any newspaper or watch any television broadcast and you'll see the proof. Endless broadcast hours and column inches are given over to the latest updates on the wars in Iraq, Afghanistan and elsewhere, the ongoing obesity epidemic or the latest diet craze, and the sex lives of celebrities or politicians caught in prostitution scandals. War, food and sex are everywhere because we demand them.

We feel compelled to fight each other, to compete and amass more than our neighbours have, whether through physical combat, political battle, verbal sparring or even just sports. War is an integral part of the human experience. Lust, meanwhile, leads people to do stupid, stupid things, from risking unwanted pregnancy and diseases by having unprotected sex to courting identity theft by giving their credit card numbers to shady websites or provoking the loss of their families and relationships by conducting poorly concealed affairs. Mythology is rife with conflicts fought over sexual jealousy, such as the Trojan War, which started when the King of Troy's son stole the King of Sparta's daughter, while even Adam disobeyed God by eating the forbidden fruit in hopes that Eve would get it on. The need for food is just as basic. Wars still start over the land that produces food, while in the most extreme cases, a lack of food even drives man to eat fellow man.

Huge industries have developed around each need; war, sex and food are not only humanity's oldest businesses, they are some of the biggest as well. But the question does arise: with three such basic instincts, why the need to tinker? If our needs are so elemental, why does meeting them require such ongoing innovation? The reasons, it turns out, are many.

The Whys Have It

As Thomas Friedman explains in *The World Is Flat*, the iron law of American politics is that the party that harnesses the latest technology dominates. FDR did it with his fireside radio chats, JFK did it with his televised debates against Nixon and the Republicans did it with talk radio. More recently, Barack Obama did it through his use of social media such as YouTube and Twitter, leaving his opponent John McCain—who admitted he didn't even know how to use his computer—looking like an out-of-touch Luddite.

The American government believes that this rule of politics, a diplomatic form of war, extends to the actual battlefield, which is why its military is both a big creator of technology and a long-time early adopter. Most obviously, superior technology gives an army an advantage over its enemies, at least temporarily and especially psychologically. Once the United States dropped the atomic bomb on Japan, there was no question the Second World War was over. Similarly, the Gulf War was quick and decisive—it lasted only two months—because coalition technology such as smart bombs, GPS and night vision allowed for a devastating aerial bombardment. By the time the ground war started, Iraqi troops were ready to give up. Today, insurgents in Iraq are more determined and aren't as intimidated by technology—still,

imagine how scary it must be to see robots firing at you. That's the sort of edge the U.S. military is always looking for, says Colonel James Braden, who fought in Desert Storm and is now a project manager for the marines. "I don't ever want to be in a fair fight," he says.²

As military officials are quick to point out, technology also saves lives. Whether it takes the form of body armour, night vision or robot scouts, that's worth any price. "America, Canada, the U.K., Australia and others are countries willing to make a substantial investment in the safety of their sons and daughters, and thankfully so," says Joe Dyer, a retired navy vice-admiral and executive with robot maker iRobot. "The value we place on any life is the engine that drives that. Two things—a reduction in the number of people that we put in harm's way and an improvement in the survivability for those that go into battle—those are the central pillars of American technology."³

In recent years, technology has focused on making fighting not only safer, but more comfortable. Pilots are now flying robot drones in Iraq from air bases in Nevada, then going home to pick up their kids from soccer practice. Front-line troops, meanwhile, get to spend their downtime with Xbox video games. There's no more playing the harmonica or writing long letters to Betty Sue back home. Now they've got email and the internet.

Besides saving troops' lives and making them more comfortable, technology can limit the damage inflicted on the enemy, particularly on civilians. This is important in weakening the pervasive circle of hate, where the ruined lives of one war become the revenge-bent soldiers of the next. "There's an efficiency in attack, but there's also a minimization of damaged infrastructure and collateral damage and lives lost in military

forces and civilians,” says Dyer. Today’s enemies, he adds, may become tomorrow’s allies.

In the United States, investment in military technology has also become a pillar of scientific research. The military and its various labs, especially the Defense Advanced Research Projects Agency, do much of the long-term work that is too expensive or far-out for industry. The internet is one example; created by DARPA during the Cold War, the communications network took a full twenty years to get up and running. Vint Cerf, the computer scientist who made the network’s first connections, says civilian companies don’t have the patience for such projects: “If I had to cite one aspect of DARPA’s style, it was its ability to sustain research for long periods of time.”⁴ As we’ll see, since its inception in the late fifties, DARPA has generated one important technology after another, including cellphones, computer graphics, weather satellites, fuel cells, lasers, the rockets that took man to the moon, robots and, soon, universal translation, thought-controlled prosthetics and invisibility. None of these were developed in one fiscal quarter. War historians and social scientists say DARPA has “shaped the world we live in more than any other government agency, business or organization.”⁵

National labs staffed with rank-and-file scientists are also key. For these institutions, performing research for the military is a win-win-win situation: they get funding to do basic scientific work and the military gets the results, which are ultimately passed on to the civilian world. Lawrence Livermore National Laboratory, west of San Francisco, is a good example. The lab was opened in 1952 with a mandate to conduct defence-related research. Livermore is responsible for looking after the U.S. nuclear arsenal, so much of its research has concentrated

on that area. You'd think such a lab would operate under the strictest of security—and it does, but the scientists there are only too happy to talk about how their weapons work has spun off into everyday life. Those spinoffs have been numerous: three-dimensional collision-modelling software, originally devised to predict the impact of bombs, now used by carmakers to simulate crashes and by beer companies to test new cans; genetic research that kicked off the Human Genome Project; laser-hardening systems that are now helping planes fly farther; and the latest, a proton accelerator beam that promises to revolutionize cancer therapy. George Caporaso, a scientist who has worked on beam research at Livermore for more than thirty years, says there's no way such breakthroughs could have happened in the civilian world. "When I came here I saw the scale of things that were being done, things private industry wouldn't dare take a risk to explore, only the labs could do that," he says. "Really high-risk, high-reward things ... very important problems for national defence and security ... things that in many cases no one else can do."⁶

A good deal of technology thereby comes from military spending. And with developments tied to how much money goes into research, the pace of innovation looks set to increase. In 2008 the world's combined militaries spent an astonishing \$1.4 trillion, or about 2.4 percent of global gross domestic product. That amount, up 45 percent since 1999, was a new record. For the most part, this is an American story, as nearly two-thirds of the increase came from the United States.⁷ American military spending increased 10 percent in 2008 to \$607 billion, or 42 percent of the global total, seven times more than second-placed China, with a relatively paltry \$84.9 billion.⁸

The United States spends so much on its military that the Pentagon's secret "black budget" of \$50 billion is more than the entire defence budget of most countries, including the United Kingdom, France and Japan, and more than triple Canada's.⁹ Much of this money flows to DARPA, universities and national labs such as Livermore. By one estimate, as many as a third of major university research faculty have been supported by national security agencies since 1945.¹⁰ No wonder the United States produces a disproportionate amount of the world's science and technology: despite having only 4 percent of the world's population, the country spends about half the world's research and development dollars.¹¹ It has also made technology part of the cultural fabric. As a U.S. Army report states, "Technology is part of how Americans see themselves, to reach for it is instinctive."¹²

Some military inventions have been commercialized in obvious ways; the atomic bomb, for one, was turned into nuclear energy, while jet fighters became jetliners. This book will feature many less obvious spinoffs, like how radar led to the microwave oven or spy satellites spawned Google Earth. The important thing is that the technologies eventually came to market. "The whole history of Silicon Valley is tied up pretty closely with the military. Integrated circuits were designed to guide warheads. All the constraints that were necessary to make that successful drove a lot of the miniaturization to work," says John Hanke, who helped create Google Earth. The military is "willing to pay millions of dollars per user to make it possible. Things have this very high value that you don't necessarily see in the consumer space. Once the technology and the basic R&D is paid for, then companies start looking for those secondary markets where you can take the things they know how to do."¹³

We've come to the point where it's almost impossible to separate any American-created technology from the American military. Chances are, the military has had a hand in it, and industry has been a willing partner. In the case of Livermore's collision-modelling software, car companies have been working with the lab since the 1980s to refine the tool. The carmakers and the lab swap software code back and forth in an effort to make it better. "There's give and go in both directions," says Ed Zywicz, one of Livermore's programmers.¹⁴ James Braden, the Marine colonel, says the military's relationship with industry has never been as good as it is today. "As you improve a ground combat vehicle, some of that spins off into the automotive industry and on the flip side of that, many of the things the automotive industry comes up with spin off into our ground combat vehicles," he says.

War also drives economic activity, a truth that governments have always known. The Second World War, for example, ended the Great Depression by stimulating demand for everything from shoes to steel to submarines. In 1933 a quarter of the American workforce was unemployed and the stock market had lost 90 percent of its value since the crash of four years earlier.¹⁵ President Franklin D. Roosevelt's New Deal, a package of social reforms, steered the economy in the right direction, but the crisis was still in full flow when war broke out. The United States saw steady economic recovery, first as it supplied its allies and then when it formally joined the war in 1941. The entire might of American industry moved to support the war effort and the nation reaped the benefits. In 1944, when defence spending reached an astounding 86 percent of the federal budget, gross national product climbed a correspondingly huge 28 percent.

In dollar terms, GNP went from \$88.6 billion in 1939 to \$135 billion in 1944. These are growth rates that economists and stock investors see only in their dreams.

The benefits went beyond mere numbers. By 1944 unemployment had dropped to 1.2 percent of the population—it has never again been that low—and even those people who couldn't normally find jobs, including many women and African-Americans, were gainfully employed. The contributions of those particular demographics during the war also did much to further their respective rights movements in the years that followed.

History looks to be repeating itself since the “war on terror” began in 2001. American defence spending has shot up 74 percent to \$515 billion since 2002. Gross domestic product saw a correspondingly solid rise of 2.9 percent on average between 2001 and 2008, before the global recession set in. In 2007 unemployment was among the lowest it has ever been. The United Kingdom, a major ally in the war on terror, experienced similar benefits. GDP grew an average 2.3 percent while unemployment hit its lowest point in more than two decades in 2007. This growth was not coincidental. As of early 2009, the war on terror had cost the United States more than \$850 billion—but much of that taxpayer money didn't just evaporate, it went right back into the industries that did the heavy lifting.¹⁶

Trying Out New Positions

The pornography industry spends money on technology too, though it generally doesn't create it: there are no labs with scientists in white coats working on better porn innovations.

Instead, the industry exerts its influence as an early adopter. Porn dollars often make it possible for technology-creating companies to stay afloat and improve their innovations to the point where they're ready for a mainstream audience. Just ask Brad Casemore, the product manager for a small Toronto-based company called Spatial View. In 2009 the company introduced software that allows iPhone owners to view 3-D photos and videos. A porn company, Pink Visual, was one of the first to license the technology and produce content with it. "The people in the industry feel a great sense of urgency to stay ahead of their competitors and, no pun intended, they have a really demanding audience," Casemore says. "It's an audience that's continually looking for new ways to access content."¹⁷

Having been at the forefront of the industry since its first issue in 1974, *Hustler* has seen more technological change than just about anyone in porn. Michael Klein, president of Larry Flynt Publications (which publishes *Hustler*), agrees with Casemore's assessment. Porn companies have to be on top of the latest technology because they are in an extremely competitive industry. If they're too slow in getting their content to people, somebody else will beat them to it. "You need to be out there and get the product out as quickly as you can to consumers," he says.¹⁸

Porn companies are able to adopt new technologies quickly because they are usually small and, like the actors they hire, quite flexible. Tera Patrick, one of the industry's biggest stars, started her own company, Teravision, in 2003, with then-husband Evan Seinfeld, bassist and singer with the heavy metal-hardcore band Biohazard. The couple says porn companies can experiment with technology because they don't have to go through layers of management. "The mainstream is slow on the go. They need

a hundred people to make a decision. In a corporate structure, people are afraid to go out on a limb because if something goes wrong, they could lose their jobs,” Seinfeld says. “In adult entertainment, if you came to Tera and myself and said, ‘Hey, I’ve got this new technology to deliver your content to people via an iPhone,’ we could run a check on your company in a matter of days, have a contract and be up and running within a week.” Patrick agrees: “If somebody pitches me something, we can move at light speed. In some cases the early bird does get the worm.”¹⁹

Even the bigger porn companies like LFP and Playboy Enterprises don’t feel hemmed in by their corporate responsibilities and behave like entrepreneurs. If a mainstream movie studio wants to try something new, Klein says, “they have to go back and get Tom Cruise’s permission or Tom Hanks’s permission, the director’s permission, the writer’s permission. We secure all those rights and we control the movies we have when we do the deal so it’s easier for us to try all these things.” The result is that there are thousands of privately owned entrepreneurial porn companies with lots of money to burn. As porn star Stoya points out, they can afford to say, “Yeah, let’s give it a shot—if it doesn’t turn out, it’s no big deal.”²⁰

This flexibility attracts non-traditional entrepreneurs who have trouble fitting into the mainstream. Scott Coffman, a serial entrepreneur who had tried to create, among other things, board games and herbal supplements, saw potential in video-on-demand because of the way people were pumping quarters into peep-show booths in adult video stores. He started the Adult Entertainment Broadcasting Network, a website where visitors can pay to watch porn on a per-minute basis, to try out the

peep-show concept online. AEBN, Coffman says, now pulls in a hundred million dollars in revenue a year, making it the largest video-on-demand provider in the world, in or out of porn. “I thought that’s the way we should be selling adult entertainment online, because guys only want to come and watch for a short amount of time. We saw the potential when most companies didn’t really care about it,” Coffman says. “We showed that you could make money on the internet with video. We didn’t just show the way in technology, but also in economics.”²¹

After graduating from the University of Southern California’s prestigious film school, Ali Joone started Digital Playground in 1993. In 1997 he bet the company on an emerging home-video technology, DVD, a move that mainstream producers were reluctant to make in light of such previous flops as laser disc and CD-ROM. “Everybody in the industry thought DVD was a fad, mainly because CD-ROM came and went. I never looked at CD-ROM as the final product because the image was small. But when you looked at DVD, the image quality was great and it was a big leap from VHS,” he says. “The mainstream waits until there’s a number of players out there.”²² Porn is also a medium that allows for unparalleled freedom and creativity, Joone says. “Adult is the last place where you can do independent filmmaking. You can make any movie you want as long as it has sex in it. As a creative person, your boundaries are huge.”

During the course of researching this book, I was surprised to learn that Paul Benoit, a former high-school mate of mine, was the chief operating officer for the company that produces the popular porn site Twistys. I never pictured him as a porn executive, but as he explains, he was attracted by the marketing opportunities and creative freedom. “What’s always fascinated

me about the industry isn't the breasts or the sex, but how willing it is to push the envelope," he says. "Being in the industry means doing whatever our imaginations can generate."²³

Porn companies are forced to innovate, Benoit says, because they are one of the most stigmatized, marginalized and even hated industries there is. As such, they face limitations, regulations and prosecution at every step. Credit card firms, for example, charge them larger transaction fees because they run a higher risk of customers wanting their money back (people don't tend to think transactions through when they're sexually aroused, which often results in buyer's regret). A growing number of countries are also looking into ways of outright blocking pornography online—and not just the violent and disturbing stuff, but simple nudity as well. One filter tested by the Chinese government even blocked pictures of pigs, which were mistaken for naked human flesh. And this isn't happening only in developing or devoutly religious countries like China and India, but in countries with supposedly strong free-speech laws such as Australia and the United Kingdom.

For porn companies, necessity really is the mother of invention. They have to get to new technologies quickly and exploit them for as long as they can, until regulators catch up. Then it's on to the next technology. "To deliver, you have to invent in order to circumvent other issues that may come up," Benoit says.

Decades of technological innovation and virtually unlimited demand have given the industry a veritable licence to print money. Many producers have resisted going public because of the red tape, including responsibilities to management and shareholders, that inevitably follows. As with traditional businesses, many

believe that once shareholders enter the equation, the ability to push boundaries lessens. Non-transparent private companies are also better at hiding information, such as how much money they're generating, which helps them fly beneath the radar of authorities and tax collectors.

All of this explains why there are only a handful of publicly traded companies that deal in sexual content, including Chicago-based Playboy, Colorado-based New Frontier Media, Barcelona-based Private Media and Germany's Beate Uhse. Playboy and Beate Uhse are the biggest, each bringing in around \$300 million in revenue a year. There are many big independently owned companies that reportedly pull in hundreds of millions in revenue each, including a pair of Japanese firms, Soft on Demand and Hotuku, London-based Dennis Publishing and a host of American companies, including Digital Playground, AEBN, Vivid and Wicked Pictures.²⁴ Aside from the big boys, there are thousands of smaller companies such as Twistys and Teravision. Accurate numbers are difficult to come by because of the industry's lack of transparency, and because, as technology historian Jonathan Coopersmith puts it, "everyone lies."²⁵

The estimates that do exist are jaw-dropping. The worldwide porn market has been pegged at a whopping \$97 billion, or more than the combined revenue of some of the biggest internet companies, including Google, Apple, Amazon, eBay and Yahoo. China, South Korea and Japan are the top three porn revenue generators, although in the case of China the numbers are likely skewed toward the manufacture of goods like DVDs and sex toys rather than consumption, given the country's strict anti-pornography rules. The United States rates fourth with an estimated \$13 billion spent, followed by Australia and the United

Kingdom with about \$2 billion each. That worldwide revenue amounts to \$3,075 being spent on porn *every second*, \$89 of which is on the internet.

While the United States only places a technical fourth in estimated revenue (though its \$13 billion still exceeds the combined revenue of the three biggest television networks, ABC, CBS and NBC, and is close to the total intake of the NFL, NBA and MLB), porn innovation, like military innovation, is still very much an American story. American producers have led every medium shift, from film to videotape to DVD to the internet, where 89 percent of adult websites originate in the United States. The rest of the world doesn't even come close; Germany is second with 4 percent of porn sites, followed by the United Kingdom with 3 percent. Asian countries make up a mere sliver of the total porn-site pie.²⁶ While pornography is a global market, the worldwide industry looks to American producers to find out what's next.

Keeping Up with the McDonald'ses

The motivation behind innovation in food technology is simple: as the world's biggest industry, the stakes in food are huge and the competition is fierce. Producers must cater to customers' tastes, even if they are unreasonable, which is more the case in the food industry than in perhaps any other. We want burgers and fries, but we also want them to be healthy. We want fresh produce year-round, even in the dead of winter. We want food immediately because time is our most precious commodity. We also want our food cheap so that we can spend our money on "more important" things, like new cars and flat-screen TVs. All of this requires technological innovation. For producers, catering

to these needs is not easy, but the smallest changes can provide big rewards. Huge differences in profit can often be measured in seconds. If a fast-food restaurant can shave a few seconds off serving a burger and then sell millions of burgers, the technology that will help it do that is well worth the investment.

Historically, stabilizing a population's food supply has meant improving agricultural methods, harvesting tools, equipment, transportation and infrastructure, all of which inevitably involve technology. The Green Revolution, which swept the world in the fifties and sixties, applied agricultural innovations such as hybrid seeds, chemical fertilizers, pesticides and irrigation methods. Norman Borlaug, the American scientist known as the father of the Green Revolution, was fond of pointing out how integral those technologies were to prosperity. "Civilization as it is known today could not have evolved, nor can it survive, without an adequate food supply," he said during his Nobel Peace Prize acceptance speech in 1970.

After stability, the impetus for innovation becomes portability and export, and it's here that the military ties have typically come in. During the Second World War, the American government spurred massive investment in new preservation techniques such as spray-drying and dehydration. These new technologies were needed to make foods last longer and withstand the rigours of travelling thousands of kilometres across the ocean, to be consumed by soldiers. The investments paid off, resulting in what food historians have called the best-fed troops in history. While the average American male civilian ate 125 pounds of meat in 1942, a typical soldier was allotted 360 pounds. Some troops were getting as much as eleven pounds of food per day while civilians made do with four.²⁷

When the war ended, the United States emerged as a food power with a huge advantage over the rest of the world. By 1946 the country was established as a major exporter, producing 10 percent of the world's food.²⁸ Its position as the first country to achieve political, economic and agricultural stability was strengthened by the fact that Europe had just seen much of its infrastructure destroyed, and by coincidental large-scale crop failures in Asia. In 1946, while Americans wallowed in the luxury of too much food, more than 600,000 Chinese died of starvation and 125 million Europeans faced malnutrition.²⁹ Today, the United States is the largest exporter of food and livestock, with nearly double the output of the next country on the list, France, followed by Germany, the Netherlands, China, Spain, Belgium and Canada (it's no coincidence that the top three food exporters in the world are G8 countries).³⁰ The American food system has, in fact, created so much abundance that it wastes more food than many nations produce. Americans spend half a trillion dollars every year at supermarkets and another half a trillion at restaurants, half of that at fast-food outlets. They also end up throwing away half of the food that is ready for harvest.³¹

Once stability and exports were established, profit became the main motivator for continued innovation in the food industry. This led to consolidation into fewer and fewer major powerhouses over the second half of the twentieth century. These huge, publicly owned companies must earn profits for shareholders or risk being consolidated themselves. Many of them are based in the United States and several, including Pepsi, Kraft, Coca-Cola, Tyson Foods (the world's biggest chicken processor) and McDonald's, are Fortune 500 companies. Together, they comprise the largest industry in the world, dwarfing even the

military, with annual revenue of about \$4.8 trillion, or 10 percent of global economic output.³² With that much money at stake, the industry is incredibly competitive—companies must continually come up with new ways to generate profits. There are two ways to do this: squeeze new operating efficiencies into the business or think up new products.

When it comes to improving efficiencies, the same rules apply as in boosting economic productivity. In economics, a worker's productivity is measured in units produced per hour worked. Economists agree that there are basically two ways to boost this output—either a business hires more employees to spread the workload or it invests in technology that allows each individual worker to do more. This rule also applies to agriculture, more specifically to farmland. The only way to boost agricultural output is to increase the amount of land being used or invest in more efficient technology. Since populations and cities are growing and arable land is decreasing proportionately, well ... there's really only one option. During the Green Revolution, this meant hybrid plants that made more efficient use of the land. But it hasn't been enough, so biotechnology companies such as Monsanto have turned to genetically modified plants and animals to boost efficiency once again. If you can grow a stalk of corn that produces more useful kernels and fewer useless leaves and stalks on the same amount of land, why not do so? Or so goes the rationale.

At the product level, processors are continually looking for new ways to cater to customers' wants, which have typically centred on food that's cheaper or takes less time to make. Recently, consumers have also started demanding healthier foodstuffs. Companies such as Hormel and Unilever, for example, are incorporating a processing method that uses highly

pressurized water in conjunction with microwaves to precook meats and vegetables. This new method cooks much faster than the old steam-based system and the food retains more of its natural taste and nutrients. The process was originally developed for the military but is now going mainstream because it gives the companies a competitive edge—healthier foods—over rivals. “They put in a lot of effort because they see there’s a benefit for their civilian market,” says Patrick Dunne, a food scientist at the U.S. military’s Natick food lab, which co-developed the technology with the companies.³³

Every food company is looking to save money in production, which is why, to take just one example, you may have noticed a steady increase in the number of foods at the grocery store that now come packaged in pouches rather than cans. These “retort” or flexible pouches, again developed by the military, are lighter than cans, which cuts down on shipping costs.

During the second half of the twentieth century, many families saw both parents go off to work for the first time, so less time was available to prepare meals. Not only did this force companies to come up with quick and easy-to-prepare meals, it also spurred the rise of fast-food chains. Technology figured prominently in both. Through the power of processed foods and new cooking innovations such as the microwave oven, a meal that took one hour to produce in 1965 was shaved down to only thirty-five minutes by the mid-nineties.³⁴ Fast-food chains such as McDonald’s built themselves on technology great and small—from big innovations such as frozen burgers and fries down to the humble ketchup-squirting gun—to provide inexpensive and easy meals for consumers in a hurry. All of this technology dramatically changed eating patterns—by 2007,

90 percent of Americans ate food produced outside of the home every day, much of it fast food.³⁵

McDonald's, the largest restaurant chain in the world with more than 31,000 outlets and annual revenue exceeding \$20 billion, is constantly searching for ways to improve food safety and quality and customer satisfaction, in order to ensure the return visits it relies on. The company recently introduced automatic fry dispenser baskets and automated drink-pouring machines to help cut seconds off order times. McDonald's has also established a Technology Leadership Board, where store managers contribute ideas for improving the system. Customers are hired to visit its test lab in Romeoville, a suburb of Chicago, to try out new inventions. "Our customers don't come in for technology, they come in to get great service and great food in a clean environment," says Dave Rogers, senior director of the restaurant solutions group for McDonald's Canada. "We look at it as an incredibly important enabler to run our restaurants more efficiently. We're always looking for ways to save seconds."³⁶ Given that McDonald's is the world's largest purchaser of beef, pork and potatoes and the second-biggest buyer of chicken (KFC is first), its technological advances have major impacts, not just on the rest of the fast-food industry but on the world's entire food-production system.

There is also one other reason to invest in food innovation: hunger is a major motivator for turning people toward war and terrorism. When you and your family are starving and the local army or al Qaeda offers you food, you probably won't ask too many questions. With the world's population set to double in the next fifty years and global warming expected to create food shortages for an additional 200 million to 600 million

people in the developing world, the problem is only going to get worse.³⁷ Part of the solution will be to move food around better (including making use of the staggering amount being thrown out by Americans) and part of it will involve more efficient food production. Both will involve more technology, not less.

Side Effects

The technologies of war, sex and food haven't just changed the goods we buy, they have also changed us as people and as a society—sometimes for the better, sometimes for the worse—in ways we rarely consider. These issues are not new. Archeological evidence suggests that one of humanity's first inventions, fire, was used for the purposes of war, sex and food. Prehistoric man used fire to frighten enemies and animals. He also used it to illuminate caves so that he could paint, among other things, depictions of sexual acts on the walls. And cave men (and women) used fire to sterilize their food, perhaps as Fred Flintstone did in cooking his Brontosaurus burgers. Moving forward through time, ancient societies invented iron and used it to create weapons, while the development of shipbuilding allowed for the spread of empires. Gutenberg's first printed book may have been the Bible, but it was soon followed by erotically charged works such as *The Decameron* and *The Canterbury Tales*, which helped pay his bills. The invention of canning, meanwhile, helped Napoleon march his troops around Europe. Had the microwave oven been invented, he might even have succeeded in his attempt to conquer Russia.

The modern technological world began in the mid-twentieth century as global war erupted. The Second World War was an unprecedented conflagration involving more nations than any previous conflict. The stakes had never been so high—the

Axis powers were bent on genocidal world domination while the Allies were determined to prevent a future under Fascism. Both sides looked to technology to gain an advantage over their enemies, and both sides invested heavily. A host of world-changing technologies emerged from this deadly competition, from jet airplanes to computers to rockets that took us to the moon. Technology ultimately provided the exclamation point to the end of the war, with the atomic bomb explosions in Japan heralding a new age of future hopes—and fears. The Second World War set in motion our continual, modern-age quest for new and better technology, a turbo-charged sprint to a world that is more advanced than even the most imaginative of science-fiction writers envisioned a hundred years ago. The effects of this epic war are around us everywhere today, so it's a good place to begin our exploration of the technology of sex, bombs and burgers.