technologies, with the length of the generation dependent on the longevity of a particular technological innovation.

Throughout our discussion, we keep our eyes on how young people have acted—as well as how they have been characterized and defined by their elders. At the same time, we maintain a sharp focus on the events of the past half century—specifically, the events that defined the spaces in which Howard, Katie, and Molly have each grown up and have helped to fashion the identity, intimacy, and imagination of the three of us, and of our peer groups. As it happens, two books published in 1950—*The Lonely Crowd,* by the sociologist David Riesman and his colleagues, and *Childhood and Society,* by the psychoanalyst Erik Erikson—provide apt contexts for this transgenerational comparison.

In such a wide-ranging undertaking, with both empirical variety and disciplinary reach, we (as well as our readers) welcome a viable and dependable throughline. This throughline is provided by our characterization of today's young people as the App Generation. Whether we are unpacking the technological or generational contexts, or reviewing our various empirical studies, we focus on how the availability, proliferation, and power of apps mark the young persons of our time as different and special—indeed, how their consciousness is formed by immersion in a sea of apps. Fittingly, in the concluding chapter, we consider the effect of an "app milieu" on a range of human activities and aspirations. More grandly, we ponder the questions, "What might life in an 'app world' signal for the future of the species and the planet?"

TWO

Talk about Technology

THE FIRST TECHNOLOGIES ARE built into our species' hardware and software. Stroke the side of a newborn's foot and the toes will spread; make a sudden loud sound and the infant will startle; smile at a three-month-old and the baby will smile back. No instruction is necessary.

Externally invented technologies have been with us for many thousands of years, and they are equally a part of human development. One can tickle with a brush as well as with the hand; the loud sound can come from a percussion instrument or a foghorn; and the infant can smile at a doll or a mobile. Nor need the young child be a passive reactor. Within the first year or so of life, the child can shake a rattle, search for a hidden phone, even drag a computer mouse and behold an object skipping across a screen . . . or, in the manner of the only slightly fanciful cartoon reproduced here, transfer funds from one account to another.

Whether part of each of our bodies, or devised by human

"*It's very important that you try very, very hard to remember where you electronically transferred Mommy and Daddy's assets.*"

Michael Maslin / The New Yorker Collection.

hands over the years, technologies provide a principal means by which we carry out actions from the time of birth to the time of death—or at least until senescence appears. Many of our greatest human achievements are due to technologies devised by humans—think of clocks, the spinning wheel, the steam engine, rocket ships. Many of our most frightening achievements are also due to technologies devised by human beings—think of bows and arrows, rifles, nuclear weapons, rocket ships (again), or, most recently, the drones with which battles in remote sites are increasingly being waged.

FOUR SPHERES TO KEEP IN MIND

In our focus on apps, we are examining a preeminent technology of our time. But in discussing apps and "The App Generation," we will inevitably touch on four different perspectives or spheres, each with its own terminology and vocabulary. These perspectives are often confused or conflated in writing—and, indeed, in *thinking* about the components and forces that characterize our fast-changing era. As much as possible, with the aim of avoiding both preciosity and pedantry, we will try to make clear on which perspective we are focusing.

- Tools and machines: *technology* in the traditional sense (ax, steam engine), typically built out of wood, metal, plastic, or other available materials;
- *Information* that can be transmitted via our own bodies or by manmade technologies of various sorts (news, entertainment, maps, encyclopedia entries);
- Information transmitted by a particular machine or tool (the television set that conveys local or international news constitutes a medium of communication; so, too, the geographical information presented on a Google or Yahoo! map)—in referring to these instances, we will use the terms *medium* and its plural, *media*; and
- *Human psychology* (sensing, attending, categorizing, deciding, acting, other processes of the mind).

So, to be concrete, suppose we are dealing with options that allow a user to find out about different restaurants in a neighborhood, such as the North End of Boston.

- *Technology* is the particular smartphone or hardware that is accessed by the user, in this case, a teenager who wants to meet a group of friends for a meal;
- *Information* is the particular set of categories of food and location that can be captured in many ways;
- *Medium* is how this information can be presented in a particular app; at the time that this book went to press, Yelp and Google Maps would be popular choices, but essentially the same information could also be written down, presented in a map, or be part of another app, say one devoted to Healthy Foods; and
- *Human psychology* entails the use of hands, eyes, ears; the attention span needed to assimilate and process the information; the decision made about where to go, with whom, and for what purposes; and reflections on "how it went."

It's not uncommon to speak of technologies as changing human nature—or at least human thought and action (what we've just labeled "human psychology")—in fundamental ways. Books have been written about the changes wrought by clocks, steam engines, nuclear weapons—indeed, famously, by "guns, germs, and steel." For the American cultural critic Lewis Mumford, the technologies of the twentieth century have increasingly come to control the options available to us, making us more and more like cogs that allow our machinery

Charlie Chaplin, *Modern Times* (1936). Film still © Roy Export S.A.S. Scan Courtesy Cineteca di Bologna.

to operate as it has been designed (initially, by human beings) to operate.[1] We create factory machines to automate work, and they end up converting us into automata—reminiscent of the hurried and harried assembly-line worker in Charlie Chaplin's *Modern Times*.

Jacques Ellul, a French contemporary of Mumford's, puts forth a far more chilling portrait.[2] He recognizes the importance throughout history of tools—usually handheld creations that allow individual farmers or craftsmen to accomplish daily tasks with greater efficiency. He distinguishes such tools from machines—more elaborate devices that operate primar-

ily on their own (beyond hand-holding) and make possible mass production by assembly-line workers. But in Ellul's view, it is naive to think of machines and tools as merely coming to dominate our lives. As he sees it, such technological artifacts usher in a fundamental change in human psychology: a way of thinking in which every aspect of our lives has to be rationalized as much as possible, measured to the nth degree, rank ordered in terms of ever greater efficiency (or some other readily quantified dimension like speed or number of "hits"). Whatever contributes to these trends must be pursued; anything that gets in the way will—indeed, *has to be*—scuttled. We end up with a species that is well embarked on a single, unidirectional, unwavering march toward a totally technological milieu.

While Mumford might see apps as sapping individual agency, Ellul would see them as symptoms of an all-encompassing weltanschauung, or worldview. Human beings only too willingly accept the premises of technology—that efficiency, automaticity, impersonality can and should trump individual goals, will, faith. Put succinctly, technology re-creates human psychology.

Our interest here is centered on specific technologies (mechanical devices) that enable communication of information (hence, in our term, on particular media). Few doubt that the invention of writing, in the millennia before the birth of Christ, brought about fundamental change in human thought and expression. Socrates thought that writing would vitiate human memory, but in fact it enabled philosophical and sci-

entific thought. There is similar consensus that the invention of the printing press 650 years ago was epochal. Gutenberg's machine undermined religious authoritarianism even as it laid the groundwork for mass education.

In the last century, in developed or developing countries, the technologies of the body, the tool chest, the factory, the weapons arsenal have been rapidly expanded and often supplanted by powerful *media of communication*. First the telegraph, then the telephone, then radio and television are objects to be touched and manipulated, entities from which to receive messages and, in the case of the telegraph (at least for those fluent in Morse or some other code) and the telephone (for anyone willing to speak up), to transmit messages as well. The specific technologies/machines are important, to be sure, but they often become inaudible and invisible, part of the background scenery—like the television sets hoisted above nearly every restaurant bar.

While some of us are inclined to think of these communication media as "mere tools," they can have a transformative effect. Replacing sea or land transportation that takes days or even weeks, telegraphs allowed the transmission of important news in minutes. Telephones permit us to communicate almost instantly with people—known to us or not—close by or at great distances. Radio and television allow us *direct access* to what is going on all over the world—news, finance, sports—as it unfolds, and provide an endless diet of entertainment, ranging from slapstick comedy to soap operas to serious

drama. In December 1936, one could actually listen to King Edward VIII abdicate his throne; two years later, one could hear the cheers throughout Yankee Stadium as the black American boxer Joe Louis knocked out his German heavyweight opponent, Max Schmeling, in one round. Movies create stars and stories and scandals that are recognized around the globe.

While Lewis Mumford and Jacques Ellul reflected critically on the full range of tools and machines, Canadian scholar Marshall McLuhan focused sharply on the mass media of communication that dominated the twentieth century.[3] He compared the world of radio and television with the earlier "Gutenberg galaxy," the world of books and print, which literate people absorbed in linear order, at their own rate, with their often idiosyncratic system of markings of content. As McLuhan saw it, each medium—which he viewed as an extension of human sensory organs—alters the relation of the individual to the surrounding world. Absorbed by the eye, one saccade at a time, print pushed toward individuality, self-direction; in contrast, the electronic media of the twentieth century catalyzed a shared, ambient tribal consciousness. Media differed from one another in the extent to which they invited, or even permitted, active participation on the part of a member of the audience: "cool" invited or at least enabled participation, "hot" catalyzed passivity and dependence. In effect anticipating the Internet and the World Wide Web, McLuhan wrote about the emergence of a global village, in which humans around the planet increasingly partook, often simultaneously, of a single, generalized consciousness. It has been said that

in 1997, within two days of its occurrence, 98 percent of the world (except young children) knew about the death, in a car accident, of Britain's charismatic Princess Diana.

Despite his prescience, McLuhan essentially lived and wrote in the middle of the twentieth century—an age of mass electronic media (the world of Howard's youth), rather than one of digital hegemony. Only in the succeeding decades (the era of Molly's youth) has our world come to be dominated by computers within the grasp of human beings almost everywhere. Desktops, laptops, smartphones, tablets, and other digital technologies do more than allow us to contact any and all individuals around the globe. In sharp distinction to the mass media of the last century, they are intensively personal and invite activity on the part of the user: *personal* in the sense that the individual user is (in contrast to radio and television) increasingly in control of what is received and when it is received; inviting *activity* in the sense that (again, in contrast to radio and television) it is easy and straightforward to transmit content as well as to receive it and (in contrast to the telephone or the radio) in that digital devices can readily and actively involve the visual and tactile senses, as well as the auditory. No longer do we simply receive messages from designated spots (and producers) around the world; we are now in a unique position to transmit our own messages in a variety of formats to anyone with access to digital devices.

This transition is captured vividly by the appearance of the first personal computers in the late 1970s and early 1980s (Apple 1 appeared in 1976, the Apple Macintosh [soon abbre-

viated to "Mac"] appeared in 1984; as if prophetically, Marshall McLuhan died in 1980). For the first time in human history it became possible for ordinary persons, not just scientists or military personnel, to have at their fingertips (indeed, at the touch of a mouse) technology that connected them instantly with the rest of the world. Anyone with a personal computer could contact other persons, create literary or graphic material or musical materials, and receive similar kinds of materials from anyone else (individual, group, corporation) that had access to comparable software and hardware. And all this communication occurred courtesy of a single elegantly designed, seductively responsive machine. While the technologies and media have changed enormously in the succeeding years, thanks in large measure to Steve Jobs and Apple Inc., we may never again experience the transcendent experience of that moment. We are reminded of Wordsworth's poetic line: "Bliss was it in that dawn to be alive, but to be young was very heaven."[4]

APPS AND HABITS

Enter apps. Only a small (albeit growing) minority at any age can write code and thereby create our own programs and procedures. Most of what we accomplish online is a result of procedures that have been created by others, with their options delimited in various ways for various purposes. And so we encounter the paradox of *action* and *restriction*. The feeling of instituting and implementing an app is active; and

yet the moves enabled by each are restricted to a greater or lesser extent (for paid apps, even access is restricted). It has been said that, in this respect, an app resembles "a gated community."[5] Restrictions can either be constricting (in our terms, dictating an app-dependent frame of mind), limiting the options available, or they can constitute a challenge—asking us what we can accomplish, despite these restrictions. They can also stimulate us to create a new application or even a new *kind* of application, thereby altering our environment so that it becomes app-enabling. (Of course, even if we do create a new app, Apple may not accept it into its App Store!) In Mumford's terms, the issue is whether we will control the technologies or whether the technologies will control us. In Ellul's terms, will applications reinforce the move toward the all-encompassing technological worldview, or will they launch new forms of expression and understanding? In McLuhan's terms, are the apps simply the newest medium, with its characteristic sensory ratio? Or do they constitute an ingenious blend of the range of electronic and digital media and open up a new chapter of human psychological possibilities?

CONTRASTING PSYCHOLOGIES

When we think of a child or an adult employing an app, we shift our perspective from technology to psychology—from the machine or the medium to the human users. In the beginning, infants are characterized by an ensemble of reflexes—

sucking, looking, grasping, startling. But these reflexes are soon supplemented and eventually supplanted by a wide range of actions that reflect a congeries of factors: the maturation of the nervous system; the specific contours of the physical environment and the culture in which the child is growing; and the pattern of intrinsic and extrinsic rewards that attend these actions. We are the species par excellence of new experiences, new actions, and new reactions. And yet we could hardly advance beyond the reflex stage unless we were gifted at creating and, whenever possible, relying on new actions that evolve into long-term habits.

As is often the case in the discipline that he helped to found, psychologist William James memorably captured this phenomenon. In his phrase, habits are "the enormous flywheel of civilization." Less poetically, they make possible the rhythm of daily life as well as the potential for human progress or human regression. Indeed, the range of habits is as broad as the array of human actions and technologies. We can acquire the habit of sucking a thumb, reciting a prayer, or solving differential equations. While we are young, habits are readily acquired and rather readily altered. As James quipped, "Could the young but realize how soon they will become mere walking bundles of habits, they would give more heed to their conduct while in the plastic state. We are spinning our own fates, good or evil, and never to be undone."[6] Indeed, the world over, child rearing is an effort to instill habits that are productive—cleaning up one's mess, practicing an instrument—while attempting to extinguish those that are unproductive, harmful to self,

harmful to others. We do not want our children to daydream during lessons, cross the street without looking both ways, lash out at someone when they become frustrated.

Let's remain in the world of psychology, a world in which Katie and Howard spend many working hours. We begin with a study that, we believe, deserves to be as well known as the famous "marshmallow experiment"—the one that documents the extent to which future SAT scores can be predicted from a toddler's capacity to withhold gratification when in the presence of an inviting sweet.[7] Psychologist Elizabeth Bonawitz and colleagues exposed toddlers to a toy. In one condition, which we'll call the "teaching condition," a knowledgeable adult demonstrated how to use the toy. Specifically, she showed that when one yanked a yellow tube, a squeaky sound resulted. In a second condition, which we'll call the "exploring condition," an apparently naive adult introduced the toy and, apparently by accident, executed an action that yielded the squeaky sound. Thereafter, toddlers were given the chance to play with the toy as they liked. In the teaching condition, the toddlers essentially repeated the use modeled by the adult, and that was that. But in the exploring condition, toddlers spent far more time with the toy and tried to ferret out various possible uses, extending well beyond those accidentally displayed by the naive adult (the same results were obtained with other nonteaching "control" conditions).[8]

With a perhaps permissible degree of hyperbole, we suggest that, on the basis of this one experimental result, one can build entire psychologies and complete educational philoso-

phies. The teaching condition epitomized the psychological approach called "behaviorism." In this brand of psychology, made most famous by B. F. Skinner with his Ping-Pong–playing pigeons and infants raised in Skinner boxes, human psychology consists simply of the organism's reactions to stimuli presented by others.[9] If a behavior is rewarded, it is repeated; if it is not rewarded, it is sooner or later extinguished. In the less happy instance, humans learn by random exploration, until they happen to find a rewarding condition, in which case they persist in that situation. In the happier instance, desired behaviors are modeled and imitated.

The rival brand of psychology, which came into prominence during Howard's own professional lifetime, is called cognitivism or constructivism.[10] On this view, skills and knowledge are constructed on the basis of the individual's own active explorations of the environment. Rewards supplied by others are fine, but the most important activities are ones that are intrinsically rewarding—based on one's own discovered pleasures as one explores the world. Imitations and modeling are possible and may be helpful; but unless one makes knowledge on one's own, it remains both tenuous and tentative.

You can easily see the integral link between these psychological theories and their associated educational regimens. Behaviorists favor the most tightly structured learning environments—generously termed "well-structured curricula and tests," less kindly termed "drill and kill." In sharp contrast, constructivists call for rich and inviting problems and puzzles, which will engage curiosity and catalyze extensive

exploration—with, at most, the "guide on the side," rather than the "sage on the stage." On the constructivist view, the best way to educate is to provide inviting materials and get out of the way.

Both behaviorists and constructivists recognize the importance of habits. For behaviorists they are simply the way that we all lead our lives—as Skinner pugnaciously and unsentimentally put it, lives "beyond freedom and dignity."[11] For constructivists, habits are a mixed blessing—needed to move on, yet possible barriers to continuing growth. To borrow another oft-quoted psychological phrase, habits can make it more difficult for us to proceed "beyond the information given." In our own terms, we may think of habits as potentially making us dependent on certain conditions or as enabling us, freeing us to do new and potentially important things.

The advent of the digital world introduces a bevy of potential new habits. These start with the simple inclination to use—or to spurn—a particular technology. In the time of Howard's childhood, one could either gab endlessly on the telephone or, as his parents urged, "take it off the hook." In our time, one can either keep one's smartphone by one's side night as well as day, put it aside during periods of relaxation or study, or take the unusual step of "burying it for the summer," as is now mandated in some summer camps.

(Of course, "mandated" does not mean "guaranteed" or "enforced." At one summer camp about which we learned in our study, campers engaged in an elaborate ritual in which each smartphone was placed into a receptacle, to be returned

at the end of the camp session. Yet, unknown to the staff, some of the parents had hidden a second smartphone inside the campers' belongings, so that child and parent could remain in touch at will. Habits can die hard not only for digital natives but also for digital immigrants—the parents.)

The decision to use—or not use—one's devices is just the beginning. One's digital habits can range from mindless repetition of a few regular "moves" to a flexible orchestration and deployment of several disparate activities. As documented by ethnographer Mimi Ito and her colleagues, most young people in America use their devices simply to "hang out"; that is, they check in regularly with their friends to see what is going on, exchange brief greetings, plan future encounters ("Hey, what's up?" optional addressee, "Dude!").[12] This use is habitual in the least imaginative sense. A minority of young people "mess around"; that is, they seek more actively to explore a particular activity, perhaps learning some steps in Photoshop or transmitting amusing video clips to a group of friends and soliciting their reactions. In this case, the "messers" are enjoying and seeking a modest expansion of their knowledge or skills, either by themselves or in exchange with others. And perhaps 10 percent of youth actively "geek out"; they spend a significant amount of time, daily or even on the hour, developing a work or play or art skill to a high degree, seeking ever greater mastery, frequently in the company of others who share their passion. Of course, each of these groups makes use of existing apps, but only in the latter case is there an active attempt to stretch the app to its limit or, in the extreme, to create and

disseminate new apps or to venture where no app has yet traveled. In the psychological terms just introduced, we can see apps either as the latest shaping technology in the repertoire of the behavioral psychologist or educator, or as a technological lever for inducing the kind of exploration endorsed by the constructivist psychologist or educator.

We can get a sense of these contrasting stances by considering two widely used apps.

With respect to Wikipedia (which is available as an app on smartphones and tablets), the minimalist approach is simply to copy or paraphrase an entry as part of a homework assignment. In contrast, should one use the Wikipedia entry as a point of departure for further research, or even edit an earlier entry in light of the dividends of such research, one enters the cohort of the geeks. Taking an example from the graphic realm, one can use one's phone's video capabilities to create the one millionth video of a cute cat, or, geek style, one could sketch out and then produce an original video about an issue on which one has strong feelings and circulate it to as wide an audience as possible.

As we step back from this foray into technologies and psychologies, let's frame the options. From the point of view of technologies themselves, we can distinguish two categories: those apps that, like Bonawitz's teaching condition, seem to dictate one's course of action, hence inculcating dependence; and those apps that, like the exploring condition, appear to open up one's possible courses of action, thereby enabling the user. From the point of view of human psychology, we can

again distinguish two categories: those individuals (and their elders) who are willing or even eager to become dependent; and those individuals (and their elders) who spurn the habitual and search for conditions that are enabling. Of course, many apps will straddle these categories; and many human beings oscillate, comfortably or uncomfortably, between dependence and independence. But at least at the extremes, the contrasts are stark and important.

POSSIBILITIES AND PROBABILITIES

In light of the alternative scenarios, let's return to the three topics we're investigating here.

With respect to *identity formation:* Apps can short-circuit identity formation, pushing you into being someone else's avatar (that of your parents, your friends, or one formulated by some app producer)—or, by foregrounding various options, they can allow you to approach identity formation more deliberately, holistically, thoughtfully. You may end up with a stronger and more powerful identity, or you may succumb to a prepackaged identity or to endless role diffusion.

With respect to *intimacy:* Apps can facilitate superficial ties, discourage face-to-face confrontations and interactions, suggest that all human relations can be classified if not predetermined in advance—or they can expose you to a much wider world, provide novel ways of relating to people, while not preventing you from shutting off the devices as warranted—and

that puts YOU in charge of the APPS rather than vice versa. You may end up with deeper and longer-lasting relations to others, or with a superficial stance better described as cool, isolated, or transactional.

With respect to *imagination:* Apps can make you lazy, discourage the development of new skills, limit you to mimicry or tiny trivial tweaks or tweets—or they can open up whole new worlds for imagining, creating, producing, remixing, even forging new identities and enabling rich forms of intimacy.

The Flywheel can liberate you or keep you going around in circles.

As for the probability of these various alternatives, heated debate already exists in the writings of the digerati. On the one side we find unabashed enthusiasts of the digital world. In the view of experts like danah boyd, Cathy Davidson, Henry Jenkins, Clay Shirky, and David Weinberger, the digital media hold the promise of ushering in an age of unparalleled democratic participation, mastery of diverse skills and areas of knowledge, and creative expression in various media, singularly or orchestrally.[13] As they see it, for perhaps the first time in human history, it is possible for each of us to have access to the full range of information and opinions, to inform ourselves, to make judicious decisions about or our own lives, to form links with others who want to achieve similar goals—be they political, economic, or cultural—and to benefit from the enhanced intelligence and wisdom enabled by a vast multi-networked system. On this perspective, a world replete with apps is a world in which endless options arise, with at least the

majority tilted in positive, world-building, personally fulfilling directions. It's a constructivist's dream.

Others are less sanguine. Nicholas Carr claims that, with their speed and brevity, the digital media encourage superficial thinking, thereby thwarting the sustained reading and reflection enabled broadly by the Gutenberg era.[14] Raising the stakes, Mark Bauerlein invokes the inflammatory epithet "the dumbest generation."[15] Cass Sunstein fears that the digital media encourage us to consort with like-minded persons; far from exposing us to a range of opinions and broadening our horizons, the media enable—or, more perniciously, dictate—the creation of intellectual and artistic silos or echo chambers.[16] Sherry Turkle worries about an increasing sense of isolation and the demise of open, exploratory conversations, while Jaron Lanier laments threats to our poetic, musical, and artistic souls.[17] On this perspective, an app-filled world brings about dependence on the particulars of each currently popular app, and a general expectation that one's future—indeed, the future itself—will be dictated by the technological options of the time. It's a constructivist's nightmare.

Drawn from diverse sources, our data speak to these debates. As we argue in what follows, the emergence of an "app" culture allows individuals readily to enact superficial aspects of identity, intimacy, and imagination. Whether we can go on to fulfill our full potential in these spheres, to take advantage of apps ("enabling") without being programmed by them ("dependent"), remains a formidable challenge.

Unpacking the Generations: From Biology to Culture to Technology

EVER SINCE HUMANS BECAME aware that organisms are reproduced, it has been possible to think of life in terms of generations. Literally, any person, nonhuman animal, or plant is the product of the preceding (parental) generation and in turn has the potential to spawn the succeeding (or offspring) generation. (For present purposes, we'll ignore the hapless mule.) Those of us raised in the Judeo-Christian traditions probably first encountered the formal idea of generations in the Bible—through the endless list of "begats." And of course, any young person who strays beyond the nuclear family encounters individuals of older generations—aunts, uncles, grandparents, the odd great-grandparent of a far-removed generation, as well as members of one's own generation—cousins of various stripes and degrees of separation. Given the traditional generational spans, Katie could easily be Howard's daughter, Molly his granddaughter.

Bearing in mind considerations of conception, calendars,