The Psychology of Evolving Technology

How Social Media, Influencer Culture and New Technologies are Altering Society

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Rhoda Okunev

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Rhoda Okunev
Tamarac, FL, USA

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About the Author

Rhoda Okunev has a master's degree in mathematics from the Courant Institute at New York University, a master's degree in statistics from Columbia University, and a master's degree in psychology with an emphasis in developmental psychology from Yeshiva University. She also has an advanced certification in finance from Fordham University. Rhoda has worked in the finance world in market risk for more than 10 years as a risk analyst. Rhoda has also worked as a researcher at Harvard University, Columbia Presbyterian Hospital, Massachusetts Department of Public Health, and Emblem Health (HIP).

Rhoda Okunev currently is an Associate at the Columbia University's School of Professional Studies in the Applied Analytics Department. She also teaches at Nova Southeastern University in the Math Department. Rhoda is an avid pickleball player.

About the Technical Reviewer

Stephen Glicksman, PhD, is a licensed developmental psychologist and director of clinical innovation at Makor Care and Services Network (formerly Women's League Community Residences), a life-span social services organization meeting the needs of children and adults with intellectual and developmental disabilities and their families. He is also an adjunct associate professor at Yeshiva College and the Ferkauf Graduate School of Psychology of Yeshiva University, as well as the founder and director of the Makor College Experience Program, a partnership program of Makor and YU providing the YU Experience for individuals with intellectual and developmental disabilities on the Wilf Campus. In addition to his Makor and YU activities, Dr. Glicksman serves as the consultant psychologist for the School for Children with Hidden Intelligence (SCHI) in Lakewood, New Jersey, and has a private practice in Teaneck, New Jersey. Dr. Glicksman has presented on a variety of developmental topics at numerous professional conferences and parent meetings, and his research has been published in both national and international scientific journals and periodicals.

Introduction

Technology is advancing at such an incredible speed that it is hard to keep track of all its progress. This book reviews many technological developments that are impacting our world as adults and influencing on our children. In many respects, the computers, smartphones, and smart devices with texting capabilities, social media, and video apps on them have transformed our world and made it feel smaller, more controllable, and much easier to manage. In less than a few seconds, we can communicate with others down the street or across the world. It is brilliant! Or is it? I mean, the consequences of these experiences could hurt us mightily. Even as adults we are constantly barraged on our phone with robocalls or people trying to scam us for money. Some pictures and videos are edited to make us believe events happened that did not occur. If we can be mislead as adults, how can we not worry about our children? Children especially can be tricked into scams, cyber-bullying, and sharing explicit photos or sexting. Not to mention, gadgets can lead to addiction to the smart device, lack of concentration, and obesity. Parents are forced to make vital decisions for their children every day about which technology devices is age-appropriate and important for our children's successful growth in the areas of motor skills, mental capacity, and social development.

This book is a framework to start a conversation about this imperative and fundamental topic; it is by no means a scientific study or definitive explanation of how parents, teachers, mentors, or friends should make decisions. Each child is unique, and each child has an individual cognitive and social learning growth process. Therefore, each child's life takes a different and amazing journey of its own.

One thing is for certain: these technological advances are here to stay, and they are only going to get more advanced. Our world is dependent and thrives on progress. These technological advances rely on and are shaped by artificial intelligence. Data science uses machine learning algorithms and transforms them into applications for images, videos, and audio content. It can recognize faces and decipher writing biases, sentiments, and feelings. These advances are propelling our world forward in ways we could not have imagined years ago. While it has become much easier to communicate with others around the world, it has disrupted a simpler life, when smart devices were not constantly at our sides with their its apps and notifications.

Colleges and universities have programs to advance these applied analytical tools and skills to be useful and usable, and new technological advances are happening fast, especially with smart glasses. Now and for the foreseeable future it is time to embrace these robotic and machine learning advances and discover how they can benefit our lives and how we can learn to control their detrimental forces so that our moral character is not weakened or destabilized. In fact, we need to learn how they can strengthen our moral character and produce a more livable and peaceful world.

This book will discuss the theories of Jean Piaget's stages of cognitive development and Erik Erikson's psychosocial development stages, along with the rapid advancements of computers, email, texting, video games, social media, and smart technologies that now utilize artificial intelligence. We'll talk about how far technology has advanced, yet the maturation process of humans is still evolving through the same stages and growth process, for the most part, as our ancestors. This will be shown by using the age-appropriate milestones criteria of the Center for Disease Control (CDC), MedlinePlus: U.S. National Library of Medicine (Medline), and American Psychological Association (APA) factsheets.

This Book's Organization

Let us begin a whirlwind journey through the history of technological changes with the intent to show these awe-inspiring innovations that have changed the world and also have created many hardships. Some of these advances have made life fun such as video games, yet the world is more weary of cybercrime activities that seek your private information.

Part I

The first part of this book discusses the scientific advances in the context of the history of computers and personal computers, word processors, Wi-Fi, email, and texting. It discusses the history of smart devices, video games, and videoconferencing.

Specifically, Chapter 1 reviews the history of computers and smart phones, including the invention of the iPhone, Samsung's smart TV and phone, and Google's Android. It also review the history of video games and video communication and conferencing.

Chapter 2 reviews the most popular search engines, such as Google. The Internet and search engines have connected the world yet have exposed our families and livelihood to blackmail and the Dark Web. We are able to critique a restaurant or salon in one click, but if we click the wrong button on our computer, we might lose access to our data because someone on the Web

decides to hold it for ransom. When Wi-Fi was developed, it connected the world in ways that were unimaginable before. This chapter will explore how and why email was invented for the military and academia.

Chapter 3 discusses the Apple, Samsung, and Google smartphones. It also goes into the history of video games and how an individual can now play games with millions of other people online all over the globe. Chapter 3 also talks about the history of video conferencing. In addition, the chapter covers how we have the ability to make and edit videos on the fly.

Part II

Part II discusses the history of social media. Each and every person who owns a smart device can connect to multiple media apps to relay their thoughts in an instant.

Specifically, Chapter 4 reviews the beginning of social media and demonstrates its impact. Social media's appearance opened communication with our neighbors, lost relatives, and friends and strangers from places around the world.

Chapter 5 discusses the advent of social media on smartphones and tablets. In fact, social media spread quickly after the creation of the smart device. Once social media was put on the smart device, it brought people closer together. People with the same views and interests are able to hang out together virtually and share videos and other media. This has also created a polarizing effect. Cyber-bullying can occur from our peers and strangers who do not hold the same views as ours or do not and agree with our online viewpoint. Different types of social media will be discussed such as Facebook, Twitter, Spotify, Instagram, Pinterest, Snapchat, and TikTok. Chapter 5 also discusses influencers.

Part III

This part will cover age-appropriate developmental theories, Medline and CDC developmental milestones, and APA factsheets guidelines. It will focus on psychologists Jean Piaget and Erik Erickson and show how their developmental theories have more stages than the behaviors described for the CDC, Medline, and APA.

Specifically, Chapters 6 and 7 examine Jean Piaget's and Erik Erikson's background and stages of development. Piaget developed four cognitive developmental stages, and Erik Erikson developed eight psychosocial stages of development.

In Chapter 8, the book will explore the CDC and Medline milestones and the APA factsheets and how they affect development.

Part IV

This part of this book will present a framework for using psychological theories, as well as best practices, to teach children computer and smartphone skills, as well as how to use social media wisely.

Specifically, Chapter 9 reviews an article by Tom's Hardware, American Psychiatric Association, American Pediatric Association, Mayo Clinic, and Harvard University on how to work with your children to teach them best practices for computer learning.

Chapter 10 discusses what behavioral and emotional problems have become commonplace today because of technology advances.

Chapter 11 concludes the book with ways you can be inspired by these industrious and awesome innovations yet wary and ready and able to take on the dark side of them.

Scientific Advances

Part I of this book will cover the history of computers as well as search engines, word processors, Wi-Fi, texting, video games, and telecommunication systems. It will discuss some of the competition between individuals and the rivalries between companies such as between IBM (and IBM-compatible or clone companies) and Apple with the Macintosh computer. Although many people and companies were involved at the beginning of these innovations, IBM, Bell Labs, and Apple's Steve Jobs are the most prominent names remembered. This book is by no means a complete collection of technological history; there are many other great inventors who contributed to the personal computer (PC) and other technologies. We will review many of the main ones.

History of Computing

The history of the personal computer and other technological advances is by no means a straight path or one person's idea. The current state is a result of many advances. At times, an invention was arrived at by chance or by mistake. Some inventions were developed for wartime needs. The technological advances that affect many parts of our lives today have a story and inventor behind them. This chapter will take a look at some of them.

To Begin With…

Ada Byron Lovelace, a mathematician from England and the daughter of poet Lord Byron, wrote the first "computer program," which was a set of instructions to solve a complex math problem. When she was a teenager, she met the Cambridge mathematician and engineering professor Charles Babbage, and they had a long correspondence about mathematics and computer topics. In 1848 Babbage designed the first analytical engine, which was the first general-purpose computer that would use punch cards. Lovelace thought that a table of logarithms could be calculated and the computer could be used as a calculating device. Although Babbage designed the machine, Lovelace envisioned a machine that could process musical notes, letters, and images. She, in effect, imagined the modern-day computer. In Lovelace's

famous notes, she used the design of Babbage's machine to compute an algorithm to calculate the Bernoulli numbers. Her invention is believed to be the world's first computer program. At the time, in part because of lack of funding, the Babbage analytical engine did not materialize.

Alan Turing is an esteemed and renowned mathematician who received his PhD from Princeton. Turing is mostly known and remembered for many ideas in artificial intelligence, cryptology, and computer science. In about 1938, Turing broke the Nazi code, called the Enigma code, using cryptology and "the Bombe" machine in Britain during World War II. This saved the allies in many conflicts, including and importantly the Battle of the Atlantic, which was the longest continuous military campaign in World War II. Much of Turing's mathematical work remains secret because of his position in British intelligence.

Around 1947, Turing joined Max Newman at the University of Manchester in the Mathematics Department where Newman received a grant to build a new computing machine called the Mark I. It was the first ENIAC-type electronic stored-program computer to be completed. The ENIAC computer has many of the properties of the modern-day computer. This was one of the first computers with stored programming. After that, Turing was recruited by Ferranti Ltd. to develop the Ferranti Mark 1, a machine that Ferranti would market commercially. At the same time, Turing continued to work on his abstract mathematics ideas and whether computers were intelligent or could think, and in 1950 he wrote an article in *Mind* called "Computing Machinery and Intelligence" that introduced the Turing test. The Turing test examines if a computer is intelligent or was able to think. The way to determine, according to Turing, is if a computer is able to think like a human, then people would not be able to differentiate between the computer's decision and a person's decision.

The modern-day CAPTCHA uses the Turing test. The CAPTCHA acronym stands for Completely Automated Public Turing test, and it is used to differentiate computers from humans. Today CAPTCHA is used as a type of security measure known as the *challenge-response* authentication process to help protect computer users from spam. It analyzes password decryption by asking users to complete a task to show that they are not an automaton trying to break into a password-protected account.

Turing thought it better to build a program that would simulate the child's mind because it would be a simpler model. So in 1948, Turing, working with his former colleague D.G. Champernowne, wrote a computer program for chess moves against an opponent. In 1950 the program was completed and dubbed the Turochamp. In 1952 it was implemented on a Ferranti Mark 1, but the computer lacked suitable power to execute the program. Turing's program did not run because the program needed to flip through the many, many pages

of the algorithm to carry out its instructions on a chessboard, and it took about half an hour per move. Turing's computer lost the chess competition, but the event was still significant and pushed forward the ideas behind artificial intelligence. Similar methods to Turing's machine learning have been utilized and sharpened by Dennis Hassabis to have computers play chess. Hassabis is a British neuroscientist, artificial intelligence scientist, and video game designer. He was a co-founder of DeepMind, which was bought by Google in 2014, and is now vice president of engineering at Google DeepMind.

Turing is also remembered for the award named after him, the Turing Award. It is recognized as the highest honor in computer science and is also known as the Nobel Prize of Computing. Turing is thought of as the major founder and thinker behind many concepts in computer science and data science.

Bell Labs and Unix

Bell Labs, formally known by other names such as Volta Laboratory and Bell Laboratories, was started by Alexander Graham Bell from the Volta Prize he received in 1880 for his invention of the telephone. In 1876 Alexander Graham Bell, Thomas Sanders, and Gardiner Hubbard filed for a patent for the telephone, and Bell Labs Company was formed a year later. In 1889 it became part of the American Telephone & Telegraph Company known as AT&T. Bell has nine Nobel Prizes, the most Nobel Prizes of any company so far. The company was sold to Nokia and is now called Nokia Bell Labs.

During the 1960s, Ken Thompson, Dennis Ritchie, and others while working at Bell Labs developed the Unix system, a multitasking, multiuser operating system for computers. *Multitasking* means new tasks can be started before old ones are finished. *Multiuser* is where multiple users can have access to the computer operating system at the same time. Software resources provide common services for computer programs. By the early 1980s, Unix was seen as a universal operating system, suitable for computers of all sizes. This was essential for the development of the Internet and the reshaping of computing, not only for individual computers but for network computing as well.

While working at Bell Labs, in 1972 and 1973, Thompson developed the B programming language, which was the precursor to the C programming language. Ritchie is known for creating the C language, which is still widely used in applications, operating systems, and embedded system developments.

In 2009, Thompson left Bell Labs and co-developed the Go programming language at Google with his colleagues, Rob Pike and Robert Griesemer. Moreover, in 1983, Thompson and Ritchie received the Turing Award for their development of generic operating systems theory and for the implementing the UNIX operating system.

The Kenbak-1, designed by John Blankenbaker and released in 1970, is considered to be the first personal computer. It had 256 bytes of memory, an 8-bit word size, and input and output restrictions. The computer did not have much power, and therefore, this computer was only good for learning the essentials of programming but not at running application programs.

In 1973 the Xerox Alto computer was developed, and the Xerox PARC computer followed soon after. The Xerox PARC was a major step in the development of personal computers because it had a graphical user interface (GUI), a bitmapped high-resolution screen, internal and external storage capabilities, a mouse, and some software. This was the first personal computer to be recognized as workable because of those listed capabilities.

IBM

International Business Machine (IBM), nicknamed Big Blue, was the first multinational and IT consulting corporation, headquartered in Armonk, New York. IBM started to work on the first computers in the 1940s that used a punch card. During World War II, the punch card was used in Los Alamos for the Manhattan Project in developing the first atomic bombs. IBM does not deny the allegations that it also corroborated with the Nazis to use the punch cards that were developed to tabulate the Census in the United States to help run the concentration camps. Also, during the war, the Harvard Mark I for the Navy was built by IBM, which was an Automatic Sequence Controlled Calculator that could add, subtract, multiply, and divide. At this time this was a novel idea. The company offered a range of hardware, software, and custom packages for the computer. Starting in 1952, IBM started working with the Massachusetts Institute of Technology (MIT) Lincoln Laboratory on an air-defense computer, which did not go too well. Then, in 1958, IBM worked with MIT on the massive computing and communication system for the United States Air Force on a project called SAGE. It was here that digital data was transmitted over the telephone, duplex multiprocessing, and other mechanics for this algebraic computer and real-time digital computer. In 1964 IBM had its first breakthrough with its System/360 family of mainframe computers because they had interchangeable software and peripheral equipment. In 1956, Arthur Samuel of IBM's Poughkeepsie, New York, laboratory used machine learning to program the IBM computer to play checkers using techniques in which the machine could learn from its own mistakes. IBM was for the most part one of the most respected computer companies in the 1970s and 1980s for its computers and technological research.

Bill Lowe was known as the Father of the IBM Personal Computer. In 1962 he received his physics degree at Layfette College. After that, he joined IBM in 1975 as a product test engineer. He moved up very quickly at IBM until he reached the position of lab director for the site. Lowe encouraged IBM to enter the PC business. The IBM Corporate Management Committee gave approval

for him to move forward to build an internal personal computer, and in 1980 Lowe selected a team to develop and launch the new product. To move quickly on the project, Lowe designed the computer with standard components and outsourced the development of the operating system to Microsoft and the processor to Intel. Following Lowe's strategy, the IBM PC was developed in one year. It was launched in August 1981 and sold far more units than had been projected, thereby legitimizing the personal computer business.

IBM was the giant of the computer industry at that time and was expected to beat Apple's market share. However, because of the shortcuts that IBM took to enter the market quickly, the nonproprietary parts of the products it ended up releasing were easily copied by other manufacturers. This outsourcing maneuver by Lowe opened the doors to the PC clones that imitated the IBM PC because it was based on relatively standard integrated circuits, a basic card-slot design that was not patented, and hardware that was outsourced to Microsoft and Intel.

In other words, IBM's major contribution in the role of the personal computer was the establishment of standards for hardware architecture among manufacturers. Because IBM outsourced and took too many shortcuts to cut the process time of developing a computer other companies where able to copy and perfect the computer to the point where IBM was no longer the significant force in its construction. In effect, IBM became only the prototype of the PC standard. In the process, Microsoft started to emerge as the dominant force because it provided the operating system and utilities for PCs whether they were IBM machines or PC clones.

Apple Computer

Now the Apple Inc. name is known worldwide primarily for its iPhones, smartwatches, and macOS computers and tablets, but it was founded originally as Apple Computer Company in 1976 by Steve Jobs, Steve Wozniak, and Ronald Wayne to sell the Apple I personal computer that Wozniak developed. When the Apple II computer became a bestseller in 1977, Jobs and Wozniak incorporated the name of the company as Apple Computer, Inc. The computer had color graphics and open architecture. In 1979, Apple released VisiCalc, a spreadsheet program that was easy to use as well. Soon after, in 1980, Apple went public with its success in selling PCs.

In 1983 the Apple Lisa was created and was the first personal computer with a GUI interface. The Lisa computer was named after Steve Jobs' daughter. GUI is a graphics-based operating system interface that uses icons, menus, and a mouse to carry out commands, such as opening, deleting, and moving files. Although a GUI operating system mainly uses a mouse, keyboard shortcuts or the arrow keys can also be used. This graphic-based idea came to Steve Jobs when he visited a Xerox Alto demonstration that had a computer

with a graphical interface. Even though it was a brilliant suggestion to put in the computer, due to infighting and its high price and limited quantity of software, Apple took a big financial hit.

Jobs was pushed off the Lisa team and went to the Macintosh division of the company. It was there that he introduced a cheaper graphical interface system than what was used on the Lisa computer. However, the Macintosh had only 128 kilobytes of RAM, which limited its speed. This was done to keep the price point low. However, once the slow speed of the computer hit the public media, the Macintosh sales slipped.

Soon after in 1985 there were more infighting and power struggles in the company mainly between Steve Jobs and CEO John Scully, who Steve Jobs had hired because the computers were not selling well. Steve Jobs resigned and founded NeXT, and Wozniak removed himself amicably from Apple at that time.

In 1990 Apple was losing market share to other companies in the personal computers arena, while other companies using the Microsoft Windows operating system expanded with Intel-powered clone IBMs. Just before Apple went bankrupt, the company brought Steve Jobs back to fix its operating strategy and restructure the company. In 1997 Apple returned to being a profitable company under the leadership of Steve Jobs, and the iMac, iPod, iPhone, and iPad were launched to great success. Apple Stores started to open, but Steve Jobs' health declined, and soon after he died of pancreas cancer in 2011. Steve Jobs' leadership brought the Apple Company to fame and glory. Tim Cook took the CEOs role after Steve Jobs' death, and the Macintosh and iPhone markets continue to thrive.

Summary

The late 19th century was the start of a revolutionary time for the design of the computer, with Ada Lovelace and Professor Babbage first imagining a computer that could solve complex math algorithms. The 20th century brought Alan Turing who was able to utilize cryptology and the technology of a massive machine to save many lives in World War II. Turing also showed that computers could have the ability to think and was the impetus for the field of artificial intelligence.

After that, Bell Labs, IBM, and Apple were able to put the technology to use by having the foresight to put a personal computer in the hands of every person. In about a century, the world had changed, but the next chapter will review some of the other discoveries that helped the computer to become more prominent and powerful and that made it more efficient and effective to use.

History of the Internet, Search Engines, and More

This chapter will review the internet and the WWW, search engines, email, word processors, Wi-Fi and texting. After the invent of the computer many inventions were developed that made life easier while using them. The internet, WWW and Wi-Fi enabled computers to speak to each other and share information. Search engines allowed users to see details of facts and figures that were on the internet instead of having to search through encyclopedias. The word processor made writing, computing and editing simpler to manage than a typewriter. Email and texting allowed the user to relay messages without having to make a call.

The Internet and the WWW

In October 1957, when the Soviets launched Sputnik, the first manmade satellite, into space, the United States panicked. Americans started to realize we needed more science and technology courses and majors at universities. The goal of the National Aeronautics and Space Administration (NASA) and the Department of Defense's Advanced Research Project Agency (ARPA) was to develop more space-age technology such as rockets and computers to rival the Soviet threat. In the 1960s, during the Cold War, MIT, Rand, and others recommended building computers that could speak to each other to enable leaders to communicate even if the telephone system was destroyed. In 1968, Advanced Research Projects Agency Network (ARPAnet) used a technique developed by MIT called *packet switching*. This technique was the start of computers communicating but did not work very well. It did lay the groundwork for the Internet, though.

In 1974, Vinton Cerf and Robert Kahn, considered the Fathers of the Internet, designed the architecture of the Internet and the Transmission Control Protocol/Internet Protocol (TCP/IP), which allows supercomputers and desktop PCs to share information across the Internet. The design allowed DARPA's Packet Radio, Packet Satellite, and ARPANET networks to interconnect and interwork. In the 1980s, only researchers and scientists used TCP to transport files and data from computer to computer. In 2004, Cerf and Khan received the Turing Award for their pioneering work on the Internet and its advances.

Then, in 1989, at CERN, a European particle-based psychics lab, Tim Berners-Lee created the World Wide Web. He developed the idea for the building blocks of the Web: the HyperText Markup Language (HTML), Uniform Resource Locators (web addresses), and the Hypertext Transfer Protocols (HTTP). These tools have made the Internet more usable and accessible and are still in use today.

Search Engines

Search engines gained recognition in the 1990s. In 1989, Alan Emtage was a systems administrator in the information technology department at McGill University in Montreal. His job was to manually go through File Transfer Protocol (FTP) servers to scour nameless files to find some that could be useful to students and faculty. His Internet connection was slow, and it was a tedious process and time-consuming to run the search process. This led to Emtage's invention of the Archie search engine. Archie is named after "archive," without the *v*.

The Archie search engine dialed the computer in the middle of the night when no one was using the link. That was the fastest way to get the job done. For Archie to search, the exact name of the file had to be typed, so users needed to know the exact title of the file they were looking for. Emtage did not patent his idea.

Although there were many that came and went, one of the more well-known search engines was AltaVista, developed at Digital Equipment Corporation (known as Digital); it used a crawler system that sent out "spiders" to record websites and build searchable indexes. AltaVista automatically categorizes web pages by natural language. The spider determines the language of a web page at the time when it spiders.

AltaVista's name came from the scenic views in Palo Alto, where Digital was based. For the most part, Paul Flaherty developed the idea for AltaVista, while Louis Monier, a computer scientist at Digital's Western Research Lab, created the web crawler tool named Scooter. In August 1995, Scooter completed its first complete web crawl by returning around 10 million pages to the primitive AltaVista index, written primarily by Michael Burrows. It was the first search engine to allow people to find images, video, and audio alongside text content. It was also the first tool that could translate entire websites to another language by using the BabelFish translator, which would later be used by Yahoo.

AltaVista was officially launched in 1995 by Digital and later acquired by Yahoo in 2003.

In early 1994, Yahoo was started and founded at Stanford University by Jerry Yang and David Filo, who were electrical engineering graduate students. The name was first "Jerry and David's Guide to the World Wide Web." This was a directory of other websites, organized in a hierarchy, as opposed to a searchable index of pages. In April 1994, the guide was renamed Yahoo. The word *yahoo* is an acronym for Yet Another Hierarchically Organized Oracle or Yet Another Hierarchical Officious Oracle. This paved the way for the yahoo.com domain, which was created in 1995.

Sometimes creations just happen by chance, and the Google story is one of these situations. In 1995 at Stanford University Larry Page toured Stanford for graduate school, and Sergey Brin, a student there, was assigned to show him around. During the tour, they argued; however, later they struck up a partnership and built Google in their dorm rooms at Stanford. At first, Page and Brin called it Backrub; they later renamed it to Google. The name was based on a mathematical expression called *googol*, which is the number 1 followed by 100 zeros. Their motto was "to organize the world's information and make it universally accessible and useful." In 1997, Larry and Seregey registered the domain name incorrectly, and instead of writing *googol* they wrote *google*. By the time they realized what they did, it was too late.

At that time, search engines were based on keywords and would process those keywords to unload their information from the WWW to the user. Brin and Page's idea returned lists of websites ranked by how often a search phrase appeared on them. They did this by embedding the number of links each website had into the search function crawlers. For instance, a website that had thousands of links would logically be more valuable than a website with just a few links. A heavily linked site was higher on the list and deemed more valuable for possible results. This technique gave the user more valuable information.

In 1998 Brin and Page received financing for Google from Andy Bechtolsheim, the president of Cisco Systems. This helped them tremendously, and in 1998 Google Inc. became a company. Its popularity ballooned very fast, with people even using *google* as verb. Google reorganized itself in August 2015 to become a subsidiary of the holding company Alphabet Inc., with Page as CEO of Alphabet and Brin as president.

In 2004 Google began offering a free web-based email account. Google developed a wide variety of products such as a word processor, spreadsheet, instant messaging tools, and more.

Emails

Electronic mail (email) is a method of sending messages between individuals electronically. In the early 1960s, email could be sent only if it was on the same computer. Not until Ray Tomlinson invented network email in 1971 was a system able to send an email to a different host user across the ARPANET at the US Defense Advanced Research Project Agency (DARPA). He used the @ sign to link the user with a destination server, which is still used today. The address became username@name-of-computer-destination-server.

Larry Roberts, also at ARPANET, wrote emails in 1972 that were based on the store-and-forward model where the server for the email accepts, forwards, delivers, and stores messages. This meant the receiver did not need to be online to receive the mail. To get the mail, the receiver only needed to log on to a mail server or webmail interface.

Eric Schmidt, for his master's thesis in 1979, wrote Berkley's Network, which was an early intranet service offering serial connections between the campus computer center and certain computing departments. Schmidt later went on to become the CEO of Google.

The first junk email—named Scientifically Processed Animal Matter (SPAM)— was sent by a man named Gary Thuerk in May 1978. By 1990, SPAM hit users across the Internet with a force that we still feel today.

In 1993, AOL developed the first version of Microsoft's Outlook as part of an Exchange Server 5.5. Hotmail was launched in 1996 by Sabeer Bhatia and Jack Smith. At that time, it was called HoTMaiL, and it was the first email webmail service. Later, it was bought by Microsoft in 1997 and rebranded MSN Hotmail, and in 2013 it replaced by Outlook.com. Elwood Edwards' voice helped the masses get hooked on checking email with the message "You've got mail."

Even though SPAM was already a problem, it was not until 2002 that the Directive on Privacy and Electronic Communication was written in the European Union to address this problem. It included a section on SPAM that made it illegal to send unsolicited communications for direct marketing purposes without prior consent of the recipient. The United States followed with a similar law. Neither law has been effectively enforced, and they have not reduced the amount of SPAM in mailboxes.

In 2004 Gmail launched as an internal mail for Google employees through an invite-only system, and a few years later it was released to the public. Its lead creator was Paul Buchheit. One of the main benefits of Gmail was that it gave users an email address that was independent of any particular Internet service provider (ISP). This made it easier for the user to maintain a permanent address. In addition, the service gave free email storage space for users to store files.

Apple around this time introduced email to the iPhone user. This iPhone technology started email use for the consumer masses. iPhones, which will be discussed soon, use a user interface built around a multitouch screen. The phone is connected to the Wi-Fi, and it can make calls, browse the Web, take pictures, play music, and send and receive emails and text messages.

Word Processors

In 1975, Michael Shrayer, a semiretired New York filmmaker, moved to California. He bought an Altair computer and believed that he would be able to use the computer instead of a typewriter to write. During this time, he developed the first word processor software for Altair and called it Electric Pencil in 1976. Altair was one of the first commercial personal computers, and it was sold by mail order. The word processor software could word wrap, insert, and delete. The company lasted until the 1980s.

Soon after, in 1978, WordStar Processor for the computer was created. WordStar was the first commercially successful word processing software program produced for personal computer. It became the best-selling software program of the early 1980s. Seymour Rubenstein and Rob Barnaby invented it. Rubenstein was the director of marketing for IMS Associates, Inc. (IMSAI), a California-based computer company. He left that software company in 1978 to start his own. He convinced Barnaby, the chief programmer for IMSAI, to join him and to write the processing program.

In 1979, Alan Ashton and Bruce Bastian created the WordPerfect processing software. They developed it for a Data General minicomputer system owned by the city of Orem, Utah. Bastian and Ashton retained ownership of the software and founded Satellite Software International Inc. so that they could sell WordPerfect to other Data General users. The first version was on an IBM PC released in 1982.

Microsoft: Word and Excel

In 1975 when most people used typewriters, childhood friends Bill Gates and Paul Allen founded Microsoft. It was originally called Micro-Soft, for microprocessors and software.

In 1978, Microsoft's sales topped more than $1 million, and in 1979 the business moved its headquarters to near Seattle, Washington, where Gates and Allen grew up. Microsoft licensed the MS-DOS operating system to IBM for its first personal computer, which came out in 1981. In 1983, Allen departed Microsoft after being diagnosed with Hodgkin's lymphoma. He was successfully treated for the disease and then went on to create and work at other companies.

In 1981, Microsoft Word, the word processor software, was developed by Richard Brodie and Charles Simonyi who joined the Microsoft team. In 1983 Multi-Tool Word for computers was released, and it was in competition with WordStar and WordPerfect; both of those programs were released around a year earlier.

Similar to WordStar and WordPerfect, Word was WYSIWYG, which means "what you see is what you get." In other words, whatever a document looked like to a user on their computer screen was how it would look when printed.

Excel was developed by Doug Klunder who became an attorney and privacy activist for the American Civil Liberties Union in Washington. In 1985, the first version of Excel was released for Apple Inc.'s Macintosh computer. It had graphics and fast processing features, which made it very popular. In 1987 the next version of Excel was for Microsoft's Windows operating system. Microsoft has upgraded and improved this software every couple of years, and it is still quite popular.

Apple: Pages and Numbers

Apple in the early 21st century introduced the iWorks suite for the Mac computer, and it has pages for word processing, numbers for spreadsheets, and keynotes for presentations. This suite is in competition with the Microsoft suite of Word, Excel, and PowerPoint.

Google: Docs and Sheets

Google bought Writely, a web-based text editing platform, in 2006 and made it the foundation of Google Docs. Writely was originally created in 1998 by Sam Schillace.

Gmail was about a year or so old at the time and could barely support the code for Google Docs, which was not stable. The developers made a deliberate decision that users would want speed, convenience, and collaborative features more than richer functionality like rich formatting, margins, and pagination, which proved successful.

Google Sheets was founded by Jonathan Rochelle and Farzad "Fuzzy" Khosrowshahi and originated from 2Web Technologies' XL2Web, which was acquired by Google in 2006.

Google Sheets was built as a cloud-based alternative to compete with Microsoft Excel. Google Sheets is accessible from your Gmail account, where all your files are accessible to the Google Drive.

Wi-Fi and Its Importance

Wi-Fi stands for "wireless fidelity," and it was invented by mistake, as some of the most awesome discoveries are. Australian John O'Sullivan, a fan of Stephen Hawking's theory of evaporating black holes and their subsequent radio waves, set out to prove the theory correct, but never did. Instead, while he was working on the problem, he realized that signals travel vast distances and could be very small and distorted by the gas and dust of space they passed through. In other words, their waveform altered from a sharp identifiable spike to a flattened curve. O'Sullivan created a tool that could identify and filter specific radio waves. In 1992, a team at the Commonwealth Scientific and Industrial Research Organization of Australian (CSIRO) with O'Sullivan worked on the technique for reducing multipath interference of radio signals transmitted for the use of computer networking, and it was patented in 1996.

Vic Hayes has been called the "Father of Wi-Fi" in 1997 because he chaired the IEEE committee that created the 802.11 standards. These standards are the specifications for wireless local area networks (WLANS). Hayes created the standards and improvement to the bandwidth that were added to 802.11.

Texting

Friedhelm Hillebrand, a German engineer, and Bernard Ghillebaert, a French telecommunications engineer, businessman, and former chief executive of Orange UK, are the inventors of SMS. SMS means Short Message Service, or texting. In 1985, Hillebrand became chairman of the nonvoice services

committee of the Global System for Mobile Communications (GSM) standard. He conducted experiments on random sentences on his teletypewriter where he found that most messages people sent were about 160 characters. This is how he determined that 160 characters were enough for a text message. The GSM group continued to work on this technology but it was not believed this technology would be popular when you could make a telephone call and not much was done to promote the software.

On December 3, 1992, Neil Papworth, at 22 years old, was a test engineer and developer. He worked with a team to develop an SMS message at Sema Group Telecoms for its customers at Vodafone UK in Newbury, Berkshire. Neil sent the world's first text message from a computer, which said "Merry Christmas" to Richard Jarvis, the director at Vodafone, who was enjoying his office Christmas party. Jarvis received the message on a big bulky handset used at that time.

In 1993 Nokia, a Finnish company, was the first handset manufacturer that supported users sending SMS text messages with a full keyboard, which used the Global System for Mobile Communications network. In 1997, it became the first manufacturer to produce a mobile phone that could text. However, Apple took the lead with the iPhone soon after, and Nokia never caught up. In 2014, Nokia's mobile phone business was sold to Microsoft. Now, texting is a popular technology we cannot imagine being without.

Summary

Some of the important uses of how computers and phones are used and enjoyed today include email, texting, and the word processor. Wi-Fi has allowed us to use our phones and computers in many places and in many ways. For the most part, we take these devices for granted because they are so ubiquitous, but each piece of technology was developed individually from brilliant and creative teams working together to enhance the technology and, at times, compete with another team of scientists. Ultimately, these technologies led to smart technology, a field that is growing in many ways today and will be discussed in the next chapter.

History of Smart Devices, Video Games, and Videoconferencing

This chapter reviews the different types of smart devices and reviews context awareness, autonomous computing, and connectivity. It discusses the invention of the smartphone and how it ultimately changed our world. It has allowed us to email, text, and word process all from our phones or other smart devices. We are even able to play video games and communicate with videoconferencing using our handheld devices. We no longer have to wait until we are home to get our next message; it is all in the palm of our hands and easy to access.

Smart Devices

SMART stands for "self-monitoring analysis and reporting technology," and smart technology uses advanced technologies like the Internet of Things (IoT), artificial intelligence, big data, and machine learning. Smart devices have three main features: context awareness, autonomous computing, and connectivity. *Context awareness* is a computing style that has user-specific data or location-based technology and sensors. *Autonomous computing* is a computer's ability to manage itself automatically so that it cuts down on the time required by professionals to maintain software updates and resolve system difficulties. *Connectivity* describes communication between hardware or software devices and other devices. Some examples of objects that have connectivity are personal computers, servers, mobile telephones, and video game consoles. Other devices like cars and appliances can also be connected to the Internet. These devices are connected to the Internet through network links. Different modes of connections are dial-up, ISDN, DSL, cable TV Internet connections, satellite Internet connections, and wireless Internet connections.

Smart devices are "things" that are connected to other "things" through the Internet. Together, they make up the Internet of Things (IoT). Smart devices share and store information or data using the cloud. The IoT describes the network of physical objects that connect and exchange data with other devices or systems over the Internet with the software and sensors.

Some IoT devices include wireless sensors, software, and computer devices. In other words, they are objects that are attached to operate through the Internet, enabling the transfer of data among objects or people automatically without human intervention.

Types of smart devices are smartphones, smart cars, smart doorbells, smart locks, smart beds, smart refrigerators, tablets, televisions, smart home devices, and smartwatches. Also, Amazon's Echo, Amazon's Alexa, Apple's Siri, Microsoft's Cortana, and Google Assistant are IoT devices powered by an Internet-connected voice assistant. Many of us are now dependent on these voice assistants. Although they are powerful tools, they will not be discussed in this book.

In the 1960s, E. A. Johnson is known for inventing the first finger capacitive touchscreen. George Samuel Hurst, who attended Berea College and the University of Kentucky and graduated with a PhD in physics in 1959, invented the resistive touchscreen screen. In 1977, the companies Both these technologies are widely used today. The capacitive is mainly used on more expensive tablets and smartphones and they are more sensitive to slight touches. The resistive touchscreen is cheaper and usually requires more pressure from the hand to work.

Once the technologies for a handheld device were there, companies were ready to put all these capabilities together.

The first smartphone-like device was conceived in the early 1990s by IBM engineer Frank Canova who realized that a chip and the wireless technology was small enough for a phone, so he is referred to as the inventor of the smartphone. While the first smartphones were bulky and long, they still featured several elements that have become staples to every phone today. They were equipped with standard-input screen keyboards, touchscreens with the capabilities to send and receive both emails and faxes, and a calendar, address book, and appointment scheduler. These phones did not take off because they were expensive and the battery died very fast.

iPhone by Apple Inc.

Apple's Steve Jobs had a vision, and in 2007, the iPhone was released first with 4 GB and then with 8 GB. At this time, it was able to connect with the Internet but not with a network connection. In 2008, a few iPhones were developed and released with 16 GB and more advanced versions of the OS system, as well as the App Store, which supported third-party applications. Siri was released initially as an app for iOS in 2010, and a few months later Apple Inc. acquired it and integrated it into the iPhone with the voice of Susan Bennett. At this time, technologies and the motivation to input these technologies into phones were pushing the demand through the roof for the next and newest device out there.

Samsung Smart TV and Phone

Samsung is now the largest South Korean company, and its primary production lines are in electronics, defense, and construction. Other areas are insurance and media and entertainment. Samsung did not start out that way; in 1938 Lee Byung-chul started a grocery store selling fish, noodles, and vegetables and sold goods from around the city. When the Korean War (1950–1953) broke out, he expanded by buying other companies and then after the war added textiles and insurance. In the 1960s, Samsung, now a family-based business, expanded even more, buying even more companies and putting into production TVs, microwaves, and other consumer products through the electronic and semiconductor and telecommunications divisions. In 1987, Byung-chul died, and his son, Lee Kun-hee, became the head of Samsung Enterprise. Under his direction, the semiconductor and telecommunication division merged with chip productions to form Samsung Motors. First, Samsung came out with a digital TV. By 2011, after acquiring more and more companies, Samsung developed the Galaxy phone, which is one of the world's most popular smartphones. Samsung has more patents approved in the United States than any other company so far.

Android Smartphone

In 2003, Android Inc. was founded by Andy Rubin, Nick Sears, Rich Miner, and Chris White. In 2005, Google acquired it. The Google smartphone was released in 2007, and the HTC Dream was launched in 2008 with many updates, all named after desserts. The Android uses a version of the Linux kernel and open-source software used mainly for touch-screen technologies like the touch-screen mobile devices. The Open Handset Alliance, a group of developers, was sponsored by Google to create free software. Google smartphones have this software as well as other proprietary software such as Google Chrome, Google Play (which is the official store for Android apps, games, music, movies, and e-books), and Google Play services. The owner of the phone is restricted to the Amazon Appstore. There are many series of the Android out, and it remains today one of the most popular smartphones.

Video Games

Humans love to play games. In ancient Mesopotamia, the Royal Game of Ur was played. The game rules of this game were simple and written on a cuneiform tablet by a Babylonian astronomer in 177 BC. Irving Finkel was able to decipher the rules from this cuneiform tablet: two players compete to race for a piece from one end of the board to the other.

Today the most played games are video games. While video games are fun to play, they can also lead to an addiction as well as isolation when playing the game solo. Other concerns are overeating while solitary and aggressive behavior due to many of the games' themes of violence and guns. The growth and enthusiasm in games will never cease, though. Gaming is and will always be a part of our world and played by millions. There are many games out there, and they are constantly being created, but only a few will be reviewed in this book.

In the 1950, Josef Kates created Bertie the Brain, the first video game that played Tic-Tac-Toe against artificial intelligence. It used a huge computer to play. In 1958, Tennis for Two was invented by William Higinbotham. This is a more interactive electronic game that uses a graphical display. Higinbotham was a physicist at Brookhaven National Laboratory on Long Island in New York and is mostly known for his work on the nuclear bomb.

Later in the 1980s and early 1990s, driven by improvements, standardization, and accessibility to the personal computer, Nintendo and Sega were developed and competed for market share. Nintendo develops, produces, and markets software and hardware for TV-linked and mobile console games. The first handheld consoles in the 1990s mostly held Nintendo's Game Boy platform. Sega is a Japanese video game company that became very popular in the 1990s. But in 1993 it lost much of its market share, but today it still makes games for all the popular consoles.

With further technological advancement in the personal computer's optical media, with CD-ROMs, graphic cards, and computer microchips, which made possible real-time polygonal 3D graphics, gaming continued to grow and started to be incorporated into the personal computer. Nintendo, at this time, partnered with Sony to develop a new CD-ROM console and attachment for the Super Nintendo system. However, Sony's deal with Nintendo fell through, ultimately leading to making Sony's PlayStation even more popular. PlayStation has been a Japanese company since 1994, and it is recognized as a global leader in the interactive and digital gaming and entertainment business.

Nintendo dominated the market with its handheld games during the late 1990s and early 2000s with the release in 2001 of the Game Boy Advance, which had high resolution, a full-color LCD screen, and a 32-bit processor. In 2004, the Nintendo DS and Sony's PlayStation Portable (PSP) came out.

In the early 2000s, Xbox, a video gaming brand created and owned by Microsoft, entered the market. Some of the consoles include Xbox, Xbox 360, and Xbox One. The game console connects to a television or other display media and provides realistic graphics. The Xbox online gaming service gave Microsoft early popularity in the online gaming market and made it a strong competitor.

Another huge shift occurred when the smartphone and mobile tablet were developed in the early 2000s. With the start of the app stores that had many different games, a smartphone and smart device owner could download and buy subscriptions of games to play with others. Angry Birds and Bejeweled took the lead and became wildly popular. Angry Birds was created by Rovio Entertainment and is a Finnish action-based media franchise. The game series focuses on a flock of birds that try to save their eggs from green-colored pigs. In 2001, PopCap Games published Bejeweled, and it became one of the most iconic mobile games in history. Bejeweled challenges players to swap colorful jewels to form vertical or horizontal line chains of three or more gems with the same color.

Then in 2012 Candy Crush Saga and Puzzle & Dragons took off.

Games in the cloud became more popular around 2010 with increased bandwidth made available to consumers. Sony started to buy smaller popular games, OnLive and Gaikai, and used them in PlayStation Now cloud games. Other popular cloud games were xCloud by Microsoft, Stadia by Google, and Luna by Amazon.

In 2013, Facebook purchased Oculus, which was developed by Palmer Luckey in 2010. Oculus was a virtual reality (VR) system for video games. PlayStation VR by Sony was released in 2016. Augmented reality (AR) games are when the game produces a real-time video game image with additional graphics. Pokémon Go, an AR game, was popular in 2016.

Video Communication and Conferencing

Video-teleconferencing, video-telephony, and videoconferencing allow people to meet each other face to face and hear each other at the same time in different locations. They can work together via audio, video, and text to give presentations in real time through the Internet.

The first video conference technology in the 1870s used audio wires, and in 1927 Bell Labs invented the video phone, patenting the word *video*, which is the prototype of the modern-day video phone. On the first call, Bell Labs officials in Washington, DC, connected with the president of AT&T in New York City. They were connected via two-way audio and a one-way video.

Before 1935, video conferencing was referred to as *visual radio* and *sight-sounds* television systems, and in the 1950s it was termed the *video phone*. In 1956, AT&T created the first Picture-Phone prototype and made the first-ever video calls using still images transmitted every two seconds over regular analog public switched telephone network (PSTN) telephone lines.

In 1964, at the World's Fair in New York, the Mod 1 (Model 1) was first introduced by AT&T, and it was called the Picturephone. People were able to communicate transcontinentally and see each other through video for 10 minutes at a time in from New York to California. For this black and white process to work, images were sent at 30 frames per second, and the participants at the receiving end could not move. This was the first video telephone device designed for the masses, but it was expensive, clunky, and hard to set up. In 1970, AT&T introduced the Picturephone Mod II for the home and office. It was expensive for a 30-minute call; it cost $160/month plus $.25 for each additional minute.

In 2003, Skype was released by Skype Technologies. Skype was founded by Niklas Zennstrom and Janus Friis and created by developers Ahti Heinla, Pritit Kasealu, Jaan Tallinn, and Toivo Annus. Skype has VoIP-based video-teleconferencing, voice calls, instant messaging, and file transfers and is able to work on landlines and mobile devices. It had a hybrid peer-to-peer and client-based system. Peer-to-peer allows each computer to act as a server for the others in the network so that the computers can share files and peripherals without a central server. A client-server system is where many personal computers can communicate with shared servers on a local area network.

In 2011, Sykpe was bought and became operated by Microsoft super nodes, and in 2017 it became a centralized Azure-based system and was not peer-to-peer any longer.

In 2004, WhatsApp was founded by Brian Acton and Jan Koum who had worked at Yahoo. They named the app to sound like "What's up?" Korum told Acton he wanted to build an app that showed the status of each user. They found the developer Igor Solomennikov on the site RentACoder.com. WhatsApp had many technical issues, and the system kept crashing in the

beginning, but then they had a release by Apple with a push notifications add-on in 2009. This notification reminded the user when they were not using the application. WhatsApp was acquired by Facebook in 2014.

FaceTime is a video calling feature that was designed, developed, and distributed by Apple for iOS, iPadOS, and macOS. In 2010, FaceTime was initially made available on the iPhone 4 and the 4th-generation iPod touch.

Zoom Video Communication was founded and developed by Eric Yuan. Yuan was born and raised in Tai'an Shandong Province, China. This software was built on romance. In 1987, Yuan was at the Shandong University of Science and Technology, and he would travel ten hours to visit his girlfriend (now wife). At times, he was not able to see her, so he invented a way to see her without traveling. In 1997, he moved to California and worked for Webex as one of the first 20 hires where he successfully implemented an online meeting platform.

In 2007, Webex was acquired by Cisco, and Yuan worked as a VP in the engineering department. Yuan reportedly pitched to Cisco the idea of a mobile video system but was turned down by Cisco; that pitch is now Zoom. Yuan left Cisco and started Zoom, which he originally called Saabee, Inc. Zoom was influenced by a children's book called *Zoom City* by Thacher Hurd. Zoom is an online video telephony service through the cloud and started out able to host only 15 people. It uses peer-to-peer software for video, chat, and phone, as well as conferences and events. In 2017, Zoom was a unicorn company, meaning a private company with a net worth more than $1 billion dollars; it became profitable in 2019 when it went public. Although Zoom was a leader in web conferencing, it was not until the coronavirus pandemic that Zoom rocked the teleconferencing space with the boom in online school learning and remote working environments.

Zoom is an American company based in California, but many of its developers are from China. Zoom has been criticized for security lapses, and in 2020 Latitia James, New York Attorney General, launched an investigation into the security and privacy concerns of Zoom. Although Zoom did not admit to doing anything wrong, it did agree to focus on the security concerns. There have been other lawsuits about security issues that have been settled with other companies, but Zoom remains a powerhouse.

Summary

The technologies discussed in this chapter have transformed our lives and the world! No longer do we have to wait for messages from a landline when we can use our smart devices held in our pockets and purses. When we are bored, we just pull out our smart device and surf the Web or video chat with friends. We may even decide to play a video game on the smart device. In Chapter 4, you will see further how we have become dependent on our smartphones to connect us with our family, friends, and, yes, even strangers on the Internet.

History of Social Media

Social media is a relatively new phenomenon in the history of computing. Social media facilitates creating, sharing, and exchanging messages, pictures, videos, questionnaires, and other content to build communities and raise funds for charities via the online processes of networks using electronic devices. In essence, it utilizes all the technology discussed so far such as computers and smartphones, including TV with Wi-Fi, texting, email, search engines, video gaming, and teleconferencing. It has changed the way we interact with each other, and each social media website and app has its own unique draw. Facebook, Twitter, Instagram, Pinterest, Snapchat, and TikTok have allowed individuals in real time to connect with others next door and from around the world to share conversations, pictures, videos, ideas, news, and an endless amount of information. Social media has become a driving force in connecting and organizing communities from small groups to large companies. Families, friends, nonprofit organizations, charities, advocacy groups, entrepreneurs, businesses, governments, and political parties all use social media to share and display their beliefs, ideas, and other content both in public and in private.

Social Media's Launch

In 1996, Andrew Weinreich founded Six Degrees, and in May 1997 it launched. It is the initial prototype of a social media platform. This site allowed users to upload a profile and interact with other users, such as friend lists and school affiliations. But it was short lived, and the world was not ready for it at this time because of a lack of people who had access to the Internet. This short chapter takes a brief look at the early stages of the social media phenomenon and how the smartphone changed the course of social media with the use of apps. In particular, Meta's (Facebook) inception which will be discussed in the next chapter.

We Have Lift Off

When Steve Jobs started Apple in 2007 and released the iPhone, the smartphone with apps, it propelled social media into a new space by shifting the focus from computers to smartphones and devices. With just a downloaded app from your smartphone, you could hear the voice of your friends and strangers, read what their thoughts and ideas were, and see pictures and videos of them. Everyone could post about their favorite things and places they visited in the past and in real time.

Pushing Movements

Through social media, people and organizations have the ability to influence others to join a group, promote a campaign, or fight for a cause. Some groups are based on hobbies such as a running club or a book club. Some campaigns are launches for products. Some causes are helpful like exposing a crime or asking to help charities and sharing community activities. However, some social media messages are malevolent and spread malicious lies to harm others or exploit and sexually traffic the innocent.

The latter is of concern and should be on the minds of everyone. Many if not most of the individual and collective memories messages promoted on social media cannot be deleted. In many instances, old posts remind individuals of past experiences and achievements; however, there is a dark side, because we may not be able to delete some posts we may later regret.

Influencers

Social media is inextricably tied to the modern-day influencer, and no story about social media would be complete without discussing how influencers affect us. An influencer is a person who has the ability to influence potential buyers of products or services by promoting or recommending these items on social media. Their role has become important in social media and to our society as a whole to push ideas and engage the public to purchase products. An influencer can be a famous actor or athlete showing off a product or a rising star that may come from nowhere who knows how to display products in a meaningful way to the public. A video or post "goes viral" when many viewers of that platform, sometimes millions, click the link to view it.

Summary

Social media has transformed our world in ways that were unthinkable when the computer was created. It was only after smart devices were conceived that the popularity of social media exploded. It has allowed us in real time to see what our friends are doing and to see the latest trends, not only from famous people but from influencers who are able to use their personality to promote sell products and speak their minds. In the next chapter, we'll review some of the most widely used and largest social media companies worldwide.

Meta, Twitter, Spotify, Instagram, Pinterest, Snapchat, and TikTok

A comprehensive review of all social media sites is far too long, so this chapter will look at some of the most popular ones: Meta, Twitter, Instagram, Pinterest, Snapchat, and TikTok.

Meta Platform, Inc. (Meta)

Facebook is now known as Meta Platform Inc. (or Meta); it was founded in 2004 by Mark Zuckerberg, a sophomore at Harvard, along with Eduardo Saverin, Dustin Moskovitz, and Chris Hughes. At that time they called the platform TheFacebook. It was originally for Harvard students to post their photographs, as well as to share details about themselves and information about their class schedules and clubs in which they participated. The idea was to force users to be transparent and to make it difficult to create false identities on the site. Soon after that, other prestigious schools were allowed to join; then MasterCard started to pay to advertise on the site. The founders allowed the advertising in order to build new, functional, and powerful customer relationships.

The site included a *wall* that allowed users to write tidbits on their profile page. In 2005, the name of the site was changed to Facebook. It introduced tagging, where users can identify themselves and others in a photo that is posted. Facebook allowed users to upload an unlimited number of photos. High school students at this time were allowed to join as well as international students. In 2006, Facebook opened its usership to anyone older than 13.

Creating an account is free on Facebook, and most of the money earned by Facebook is through advertisements. Users are able to create profiles, upload photos, join groups, and create groups. The Facebook features are timelines, statuses, and news feeds. The timeline is where users can post their content to friends, and their friends can respond with messages on the user's profile page of their entire life, not just of recent posts. The status feature is an alert system for the users' friends to be notified about the location and situation of each other. The news feed shows changes to the profile and status of their friends, and it collects a wall of user friends in one place.

On Facebook members can chat and send each other messages privately and publicly. The controversial Like button, which allows other users to endorse posts, started on Facebook around 2009. It appears that even Zuckerberg paused before permitting the Like button to be introduced. At first he called it the Awesome button. It was developed in 2007, but he waited a couple of years before introducing it to the public. Now you see some form of the Like button all over the Internet.

Facebook went public in 2012 and started allowing marketing companies to mix their ads in with the status feature updates and photos of users. Later that year Facebook bought Instagram, which will be discussed later in this chapter.

There was a lot of controversy in the beginning stages of this site and a lawsuit evolved out of it that was settled out of court. The claim was that Zuckerberg had stolen the idea of the site from Tyler and Cameron Winklevoss, two Olympic rowers, and their colleague, Divya Narendra. In 2008 there was a settlement among the parties purported to be for $65 million.

In 2021, Facebook rebranded its name to Meta. These problems were discussed by the whistleblower, Frances Haugen, in a testimony on Facebook, the reasons may be because Facebook is challenged by privacy and safety allegations and that it could be more transparent about its business relationships. The value of the stock has also declined. The name Meta is from science fiction and may indicate Facebook's attempt to universalize the way it communicates, particularly in the Metaverse, and this may help it reach other users to exceed its revenue and expectations and environment.

At Meta, the metaverse is a type of virtual environment where the user is able to virtually meet, work, and play using virtual reality (VR) headsets and glasses on their devices. It is a real-life video game.

Twitter

Twitter, initially called Twttr, was developed and launched in 2006 by Jack Dorsey, Evan Williams, Biz Stone, and Noah Glass and was sold to Elon Musk in 2022. Dorsey created the first Twitter account and profile and sent out the first tweet. It is a social and networking site on which users post with messages called *tweets*. A *retweet* is a tweet that can be forwarded by other users to their own feed. A quote tweet is a retweet with a comment added to a tweet. Registered users can post, like, and retweet, while users who are not registered can only read publicly available tweets. By default, tweets are publicly available, but the sender can restrict the message to only their followers. Users are allowed to mute, block, and remove users that they do not want to interact with. Users can post to topics or use hashtags to promote their tweets. In 2007, Chris Messina debuted the hashtag, which is one of the most recognizable features of Twitter. In 2008, Evan Williams became CEO, and Jack Dorsey became chairman of the board.

Twitter grew quickly to become one of the most popular websites, and it allowed more advertising in the form of tweets to promote products. In 2013 Twitter launched a video-sharing app called the Vine, which had been founded by Dom Hofmann, Rus Yusupov, and Colin Kroll. It was a social media platform that allowed users to upload and watch six-second videos. It was similar to Instagram's app in functionality and interface to share images, but its purpose on Twitter was only to share videos. In 2016, Vine closed due to competition,

lack of profit, personnel turnover, and internal issues at Twitter. Twitter later regretted shutting Vine down, and, in its stead, TikTok was born in 2016 and will be discussed soon.

In 2013 a new update timeline feature was introduced that allowed Twitter users to link up conversations in chronological order. A year later Twitter promoted a service that allowed videos straight from the Twitter feed. In 2015 Google and Twitter joined together to ensure that relevant Twitter posts, images, and videos appear in search engine results.

In 2015 Twitter introduced the Curator, which enables publishers to create complex keyword and hashtag queries to uncover streams of high-quality tweets. These queries can be refined by follower counts, location, and languages to uncover the most relevant tweets to that topic.

Moments in Twitter was a tool that allows you to create slideshows using tweets from different users. Moments were used for telling stories, sharing news, or creating collections of favorite tweets. "While you were away" is a service that shows what Twitter thinks are the best tweets users may have missed since their last logon. Twitter's features give users a global reach to communicate their ideas. As a result, Twitter is appealing not only to individuals but to many businesses and organizations.

Spotify

Spotify was founded in 2006 by Daniel Ek and Martin Lorentzon to deal with music piracy and went live in 2008; its headquarters is in Stockholm, Sweden. Its parent name is Spotify Technology S.A. The name Spotify comes from two words: *spot* and *identify*. Spotify at first was limited to Scandinavia, the United Kingdom, Spain, and France, and now it is in more than 180 countries. It is an online and offline audio streaming and music streaming service provider that provides a platform to store a large number of different types of songs on devices. For the online version, a premium membership is needed. It has podcasts, videos, and music. Spotify brings affordable music to listeners and copyright-protected podcasts and music to its users. Spotify has a good search engine that allows users to type a song, artist, genre, or album to find songs.

Spotify was seen for some as an unwanted middleman. That is when Spotify launched Spotify for Artists, which is a feature that provides a platform to manage artists' profiles, accumulate audience statistics, and promote their music with merchandise. It is an attempt to help artists create fans and earn revenue from their music.

Spotify's tagline is "Music for Everyone," and its mission is to "unlock the potential of human creativity."

Instagram

Instagram was launched in 2010 by Stanford's Kevin Systrom as a photo- and video-sharing social media site. Instagram is a combination of *instant camera* and *telegram*. Instagram was originally called Burbn because Systrom was a fan of the liquor. In the beginning, the application was too complicated, but then he looked at the data to see what the customers were interested in and converted the app to a photo- and video-sharing site.

Right before its initial public offering (IPO) in 2012, Facebook acquired Instagram. The provision with the sale was that Instagram remain independently managed. Instagram was a profitable investment for Facebook.

Instagram's main feature is photo and video sharing. Users can create a free account and upload, edit, and organize media with hashtags and geographical tagging and locations. These hashtags and location finders allow users to search for other users. Users are allowed to make their media sharing public for all on Instagram to see or private for only their friends. Users can like and follow other users, and users can hide the likes as well. Another feature is the explore feature, where Instagram selects content for its users and each user sees different content based on the posts they like and who the user follows. In other words, it is a collection of posts that Instagram thinks the user would enjoy. Another feature is Instagram Stories, which allows users to post photos or videos that automatically disappear within 24 hours.

Pinterest

Pinterest Inc. was founded in 2009 and launched in 2010 by Ben Silbermann, Evan Sharp, and Paul Sciarra; it is based in San Francisco. Pinterest social media focuses on image sharing that is not real time, and it requires registration. Pinterest comes from the words *pin* and *interest*, and it is like a corkboard that uses push pins to display images or documents. The Pinterest boards are a collection of pins within a theme or multiple themes. Silbermann wanted to create a community that would grow organically. He did this by setting up a campaign called "Pin It Forward." For this campaign, users would create a visual pinboard and invite friends to also create their own pinboards. In 2012 users did not need to be invited to join the site any longer. Business accounts were created as well. Posted content on Pinterest can be shown to other users who can save it or repin it. Buyable pins are advertisements based on users' interest or results from visiting a site that the user can buy from

Pinterest. Users can follow or unfollow other users and boards. Pinterest can search with images, not only words. The pins, repins, pinners, and repinners who have the most clicks are considered popular and usually feature the products that will sell the most.

In 2017, Pinterest removed the Like button and instead enumerated that the pin board was a collection of posts. In 2019 Pinterest became a public company and is still similar to what it was before it went public.

Snapchat

Snapchat, Inc. was developed by Snap, Inc. The company was founded in 2011 by three Stanford students: Evan Spiegel, Reggie Brown, and Bobby Murphy. It is a social media video sharing service that uses short videos or stories with disappearing content after a single viewing by the receiver. Snapchat's mission is not to just include a traditional point in time but to capture a moment in time full of a range of human emotions. A snap is a photo or short video that can be edited and that includes filters with effects, captions, and drawings. In 2013, Snapchat added the features Story, which is private to friends-only viewers, and Our Story (now Live Stories) for the public through video chat. For the story, the users publish a photo or video where it lives for 24 hours. The feature Discover allows brands to show short advertisements. Another feature called In My Eyes Only allows the user to keep their pictures private, and it has a personal identification number (PIN). Users' friends can watch the story, and the user can see who viewed the story. There are geographical stories and stories that surround events, sports events, festivals, holidays, and cultural themes. Snapchat rebranded in 2016 to Snapchat Inc. because they introduced Spectacles, which are smart glasses with built-in cameras that can record videos. At this time, Snapchat developed the feature Memories where the user could privately save snaps and stories. In 2017, Snapchat rebranded to Snap.com and also this year allowed the user to play with emojis and stickers and fill in backgrounds.

TikTok

In 2017, TikTok was developed by the Chinese tech company ByteDance as a social media networking application. TikTok features short 15-second to 3-minute videos of dance, comedy, education, and much more. TikTok users can create videos using a music genre and then speed up, slow down, and edit their music videos with filters. Users can lip- sync to popular songs as well. TikTok has a For You page where they recommend to users, using an artificial intelligence algorithm, based on what they listen to; these pages aid influencers. Influencers, the most popular users, are known as meme machines, and popular influencers on this site can earn money through likes and comments.

Users can accept the recommended music or not. Users can also react, another feature, to the music they hear.

TikTok is initially on public mode, but it can be changed to private mode to be viewed only by friends. In 2018, TikTok merged with Musical.ly to develop a larger user base. It is very popular with teens and young adults. In fact, it has turned ordinary teens to singing stars. Many famous celebrities and sports teams also use TikTok. Sony Music and Warner Brothers have signed leases with TikTok.

Summary

Social media allows people to broadcast their thoughts and ideas at a moment's notice, and it can influence a viewer's opinions and provoke them to buy certain products. It is quite an influential tool. Social media is also constantly changing. There are positive aspects to it like enhanced sociability and entertainment opportunities; at the same time, it can spew hate and mistruths that are harmful. It is a new-world voice that transcends traditional TV ads and posters and billboards. Although our governments may try to control social media, each one of us has the ability to instill in our families and friends and even strangers a sense of responsibility to use it for moral and virtuous acts of kindness toward others.

Synopsis of Psychological Theories

Is it possible to put all of the technological advances you've learned about into a framework so that humanity's adaptation and growth can be better understood? Can we as a society use the technological benefits to thrive? This part of the book will describe two psychological theorists, Jean Piaget and Erik Erikson, and their stages of development. Their theories are from the mid-twentieth century and complex, but this book will attempt to explain the ideas behind each theory in plain language.

Developmental psychology is the study that attempts to explain why humans change in their life cycles and how these changes make a difference. Piaget's theory examines cognitive development, and Erik Erikson's studies examine psychosocial development. These two theories go hand in hand to explain much of human behavior at various times. The physiological aspects are not covered by these theorists and will not be covered in this book. No theory can explain all human interaction and reactions, but together these two theories provide context on how humans are changing and growing at different ages. They give insight into the strengths and challenges humans have at each stage. In effect, this part gives a framework for the outcome of successes and challenges that can occur at each stage of development.

Artificial intelligence scientists are actively seeking to understand ways humans think so that they can have machines or computers do tasks that only humans are capable of solving right now and, as stated earlier, it was Turing's idea to simulate the child's mind. There are holes and gaps in the way we understand how humans think and grow, but that is to be expected, and no theory will completely solve all problems. This is true of any problem. If we knew every reason why humans acted and reacted in the way they do, it would be easy to program a computer to do the work instead. Humans are complicated and complex, and therefore it follows that theories that try to imitate them will be as well.

Piaget's Life and Cognitive Developmental Stages

Jean Piaget was a Swiss developmental psychologist who lived from 1896 to 1980. In this chapter, we will first take a quick look at his life and at his work and then turn our attention to his four main developmental stages: sensorimotor, preoperational, concrete operational, and formal operational. The substages of Piaget development theory will not be reviewed in this book. Piaget cognitive theory is important even today because it helps us understand that even with all these technological changes, individual's thinking has not changed but evolved with time. More importantly, individuals are only capable to comprehend their age-appropriate level of cognition.

Piaget and His Work

Piaget received a PhD in Zoology. He also studied psychoanalysis with Carl Jung and Paul Bleuer at the University of Züricha. In the 1920s Piaget worked and collaborated with Alfred Binet and Theodore Simon on human intelligence. The Binet Intelligence test was a way of measuring intelligence at different ages. Binet was asked to test French children when they entered school, and Piaget was asked to administer some intelligence tests. It was at this time that Piaget thought this method to test human intelligence was too restrictive and did not take into account that children did not have full life experiences at this point; he thought they had a limited comprehension due to their maturation and experiences at this age to answer the questions.

Piaget considered himself a genetic epistemologist who believed that while genetic factors play a role in the development of the health and disease of individuals, there were still environmental factors involved. A genetic epistemologist's role is to search for the factors of cognition and how they are acquired. What are the various types of developmental knowledge as human go through at different stages of development, and what are their limitations?

Piaget was also a constructivist and not a Watson behaviorist like most psychologists at the time. Behaviorists emphasize the outward behavioral aspects of thought and for the most part disregard the inner experiences. A constructivist believes that individuals construct their knowledge rather than passively take in all the knowledge. In other words, as individuals grow and experience the world they live in, they build those representations and incorporate their own knowledge with their preexisting knowledge. Piaget believed that humans develop knowledge through their interactions with others and their own reflections of their pre-existing knowledge.

Piaget married Valentine Châtenay, and they had three children. Piaget observed his three children as they grew up and as they passed through disparate stages of cognitive development. More importantly, he conducted scientific research on groups of children and their different actions at different stages of development. He wrote many articles and books in the 20th century on the stages of development. His theories characterize language, memory, reasoning, and morals for each age-specific thought and behavior. Piaget did not believe that the mind was a blank slate. He thought that children's play and their interaction with the world played an imperative role in the growth of cognition. This means that children learn through the action of doing activities that are different at each stage of development. He believed that learning occurs by observing and imitating and interpreting situations. Piaget described the ability of humans to cope with a changing world through continuously organizing and reorganizing experiences and that reasoning or abstract thinking was the highest point of cognition. Piaget thought that the child was like a philosopher who perceives the world as he experiences it. At birth and early in life, the baby's universe revolves around its needs and

pleasures. Later in life and gradually the child will learn how to play and interact with others. Piaget perceived that babies are born with genetic determinations in their nervous system and sensory motor organs. At each stage of development, the child will have limits, and as they develop, their ability and structure of interaction become more flexible, effective, and efficient with the environment. All these interactions with the environment are cumulative, and therefore each experience will lead to adjusting and readjusting for the next experience, which comprises their learning and knowledge base. The adaptation or adjustment to new environments has dual processes, which he believed were the principles of human functioning called *assimilation* and *accommodation*. Assimilation is the process of taking in new information and integrating it into preconceived notions about objects or the world around us. Accommodation is the way to adjust to new experiences or objects by revising how old experiences were dealt in the past to fit in with the new information. How this works is that at first the child will attempt to understand new experiences by applying old solutions (assimilation), and when they are unable to do that, because they never saw that situation before, the child will be forced to change their conception of the world to interpret the situation (accommodation). This dual process of assimilation-accommodation will lead the child to develop and form schemas.

This schema is the way humans organize information so they can use it to interpret the objects and situations that can be heard, seen, smelled, and touched. At first, a baby or young child that is starting to have experiences in the real world has an overwhelming curiosity and will distort information to fit their schema and not try to adjust their schema. As the child is introduced to more experiences and objects, the child will accommodate the new information to adapt to these situations. This adaptation is the equilibrium between the self and the environment. An equilibrium occurs when there is a balance between the process of assimilation and accommodation.

Piaget referred to four components that guided development, which are emotion, maturation, experience, and social interaction. All these components work in tandem to guide development and work in disequilibrium to create learning. The way to create motivation and excitement in learning is through the feeling of emotions. Through this process of differentiation of their nervous system's mental structures and as children grows physically, they become capable of greater understanding. This maturation produces the physical feeling that excites and motivates an infant or child to learn. Experience is key and is the catalyst in which discoveries occur. It is through exposure to different scenarios and a variety of experiences that the child discovers and learns. There are limitations; for example, a parent can show a 2-year-old how to calculate an algebra problem, but they will still not have the capacity to do so. Therefore, each stage of development matters. The child socially interacts with their parents, teachers, and other children, and as the child receives feedback, this will motivate and excite learning organically. Play is essential for the development of cognition in children.

Piaget's theory proposes that as children mature, their environment and play encourage cognitive and language development. This is the way by which children develop and refine concepts before they have the ability to think in the abstract. Two of the most important developments that are produced from play are interest and motivation. Play is healthy and essential for children to reach important social, emotional, and cognitive developmental stages. There are different types of playing for children such as unstructured free play, compensatory play, and parallel play.

The later stages of cognition build and evolve from the earlier experiences. For a baby, the cognition is exploring their environment in the form of tasting, pushing, and pulling objects. Later, as the child matures, the child will begin to think by classifying, sorting, integrating, and matching information. Cognition occurs when there is an equilibrium between assimilation and accommodation, and intelligent thought occurs when assimilation outweighs accommodation. For a baby, thought is at the sensorimotor stage as they explore their environment through pushing, pulling, and tasting. As the child matures, the child's movements will be more egotistical because they have more flexible movements. Some sequences of behaviors that are both internal and external for each human will occur at different times. In other words, some children will grow cognitively faster than others. However, all children go through the same stages to develop behavior, and the sequence of stages is fixed and unchangeable. However, the process that children go through in the different stages is disparate, and the timing varies. Again, it should be stressed that all children go through the same stages. The way that a child will interact with the world and move from one stage of development to the next stage will be different. And, at each stage of development, the child will develop more complex and flexible motor skills and cognitive abilities. This means that as the child transitions from one stage to the next, different behaviors are associated with them, and the transition will be gradual. Experience and culture affects when a child will reach a stage and also when the child is physically and psychologically ready to learn. Each child will act differently at different stages of development. No disadvantage or advantage is viewed for any child at any stage of development; however, at each stage there will be an average characteristic, which can vary.

Piaget's Main Developmental Stages

The stages featured in the following sections will focus on the objective, the characteristics, the cognition needed, and the language level developed. Note that each stage should occur in consecutive order, but the time it takes each child to go through those stages will vary.

Table 6-1 provides a snapshot of Piaget's four stages of cognitive development.

Table 6-1. Piaget Stages of Cognitive Development

Age	Stage	Objective	Characteristic	Cognition	Language
Birth–24 months	Sensorimotor	Object permanence	Sensory curiosity about the world.	Imitation; uses pushing, pulling, sucking, and pushing, along with tasting, smelling, and listening.	None; progresses to representational and symbolic thought.
2–7 years	Preoperational	Symbolic thought	Language, memory, and imagination are egocentric and unsocialized.	Egocentric. unsocialized and intuitive behaviors. Pretend play.	Language and grammar used in expression, and imagination and intuition used.
7–11 years	Concrete operational	Operational thought	Logical operations in applying reasoning. Logic is concrete and tangible material.	Playing games. Time, space, and quantity are understood. Less egocentric. Math transformation.	Less focused on themselves, more socialized, vocabulary grows.
11 and up years	Formal operational	Abstract thought	Able to use symbols for abstract thought.	Abstract and logical reasoning. Able to formulate hypotheses. Strategy planning and moral thinking. Deductive reasoning emerges.	Collaborate with each other in a meaningful manner. Have conversations about topics.

Stage 1: Sensorimotor Developmental

The sensorimotor developmental stage is from birth to 24 months old.

The objective of the first stage is objective permanence. At first a baby does not realize that objects exist when they are not around them; it's an "out of sight, out of mind" experience. The baby starts to see near the end of the stage that even though there is a hidden object that it still exists. The child will also start to know that even when the parent leaves the room, they will come back.

The characteristic of the baby's experience is by means of motor activity of pushing, pulling, and sucking without using symbols, and for the baby all its experiences are learned through trial and error.

Cognition happens through imitation by way of trial and error, and the motor skills of the baby's activities gradually become more flexible. This means that the baby copies or imitates what the adult movements are and the child practices. Examples are when the baby pushes, sucks, and pulls; when the child starts to stand and walk; and when using their motor schemas of grasping and releasing their hand. When they start to move further, they will develop the mental schemas of "near" and "far." The baby is able to understand the world by way of tasting, smelling, and listening techniques. Sounds like crying and whining show the amount of pleasure or unpleasant feelings the child is experiencing. Around the first year of life the infant begins to play and learns through imitation.

From birth to 24 months the child has essentially no language skills. Around the first year children do start speaking their first words but the understanding of words as symbols cannot develop until object permanence develops.

Stage 2: Preoperational

The Preoperational stage is from the age 2 to 7 years old.

The objective at this stage is symbolic thought. In the beginning of this stage, children are more flexible in their movements but are not able to think logically. By the end of this stage, children have acquired considerable language skills, and children's worlds are represented in symbols. At this stage, children are completely egocentric and see the world around them from an egocentric perspective. Children at this stage (preschoolers) use symbols to represent their mental images. These symbols depend on children's own perception and intuition. Children are very curious about what is going on around them and exploring. They are always asking why something is happening. Because these children have egotistical and limited abilities to explain their thought processes, which are not as advanced as adults, they may make up situations at this stage.

The characteristic at this preoperational stage is the development of some language, memory, and imagination capacities.

The children's cognition at this stage is egocentric and intuitive. Children start out having a bit more advanced and flexible symbolic imitation than in the sensorimotor stage. Here is where they use things other than the original objects, actions, or ideas to symbolize those things. Symbolic play begins around the second year to around 5 years old. At this time, children start doing things for a reason.

Children will start to play make-believe and pretend, and children will also distort reality to give it meaning. Children may use play and use make-believe to correct and alter reality, and they will do actions through make-believe that

cannot be done in reality. In other words, they may act out in a situation that is fearful in reality to them. Another example may be if children are hit by their parents, they may in turn hit objects like dolls. This is where children reenact their experiences but modify original outcomes. Parallel play is when two or more children play near one another but do not interact directly with each other. Children may observe each other's actions while they play with themselves and have entire monologues by themselves with their toys or dolls, and they may also even mimic the children's play next to them.

At the ages of 4 to 7 years old, children start to learn games that have rules. Games with rules can become more involved and run into the next stage, the concrete stage. Play helps children learn more about the world and probably has a lot to do with the development of children's personalities and developing morality.

Language begins around the age of 2 to 4 years old. Language evolves and becomes more flexible as children have developed object permanence from the sensorimotor stage and know that things and objects exist to the preoperational stage. Even if they cannot reach for the object, they start using words to refer to them, and they know they exist even when they are in a different room. Once object permanence is complete, there are words that refer to objects and things. At this time, children language begins to grow rapidly but their language is egocentric. With this activity, children do not care who is listening and will talk to themselves without regard to who is in the room. Children's speech may not make sense, and it may be hard to decipher what children are saying at this point. It is common for children to have soliloquies or entire conversations with themselves.

There are different types of speech at this age. Echolalia is repetition in speech and where children are so absorbed in their play that they are not aware of what they are even saying. Delayed echolalia is where children may repeat what they hear from perhaps a conversation between their parents. Collective monologue is the most socialized form of speech at this stage. This is a form of egocentric, unsocialized speech in which children talk among themselves in group settings but do not meaningfully communicate with each other. The words of one child are unrelated to the words of another.

Stage 3: Concrete Operational

The concrete operational stage is from 7 to 11 years old.

At this stage the objective is operational thought. Children are less egocentric, and they are more aware of what is going on around them. Here children are able to perform mental thought. And by the end of this stage, children are able to perform simple math operations.

This stage is characterized by logical operations of applying logical reasoning. These processes are conservation, reversibility, seriation, and classification. These mental acts are not at this time applied in hypothetical situations but are still concrete in nature. Conservation is when children are able to conserve or know that a quantity remains the same even though the physical appearance may change or the object may be stretched, cut, elongated, or spread out. Preoperational children believe there is a different quantity if a container is changed but has the same amount of water, while children in the concrete stage will be able to know that it is the same amount of water that was transferred from one container to another.

Reversibility is a mental operation that reverses a sequence of events from the original condition. Math and logical operations are examples of reversibility. If the child has ten items and takes away three items, then there are seven items remaining. And, if the child adds three items back, the remaining items will be the original ten items.

Seriation is the process of arranging a collection of items in a specific order on the basis of a particular dimension and uses the concepts of numbers, time, and measurement. A simple exercise would be children putting toys in order from small to medium to large.

Classification is the ability to identify properties of categories, to compare from one category to another category, and to use categories to solve problems. Here children know that regardless of whether the cat is a Siamese cat or a Persian cat that they are both cats.

The cognition at this stage is that children play games, their vocabulary grows, their awareness is acute, and their concentration is heightened. Children learn better how to interact and be in harmony with each other through game playing. Their thought process tends to be even more flexible, and they learn delayed gratification. At this stage, empathy and imagination can develop through children dressing up like others and pretending to be another person. By the end of this stage, children can add, subtract, multiply, and divide.

Language evolves around the age of 5 or 6 years old, and by 7 or 8 years old children's speech, although still focused on themselves, starts to expand to what other children are trying to say. Children start using language for social interaction and communication instead of egocentrically at this time. When in the past the world revolves around them, they gradually become more socialized as they enter school. Children's language pattern at this time is a transition from immature and illogical to mature and logical thinking. In school children start socializing by interacting and talking to each other, and they start sharing toys and food. It is at this point that children start to ask questions, give answers, order commands, and criticize others.

Stage 4: Formal Operational

The formal operational stage is from ages 11 and up. The objective at this stage is abstract thought. While concrete thinking refers to what is happening now, formal operations can deal with thinking about what will happen in the future.

At this stage, teenagers, young adults, and adults can use symbols to refer to abstract concepts, and they are able to hypothesize, understand theoretical concepts, and have meaningful relationships and conversations. Their thought is more rational, systematic, and flexible.

Their language ability is that they are able to formulate hypotheses, have a conversation about topics, see more solutions to a problem, and systematically test their ideas to answer problems.

Cognition is shown when they are able to collaborate with each other in a discussion on a meaningful topic, not just an action, and there is a purpose in mind. Arguments at this time can occur, but they not only relay opposition but factual reasons and explanations with proof of why they disagree with the view stated. This is a time when young adults and adults forgo egocentric monologues for socialized interactive speech.

Piaget's theory of development proposes that cognition changes as children gradually grow. Children develop constructs of mental models of the world and acquire knowledge with the ability to work with others in meaningful relationships using abstract thought.

Summary

Piaget is indeed a pioneer in the field of developmental theory, and his theories have withstood time and the evolution of societal growth. This will be further discussed in Part III of this book with milestones and factsheets from respected institutions. Through research at different stages of development, he saw and demonstrated behaviors by clarifying different characteristics in disparate stages of cognitive development. His insights are invaluable even today for studying healthy and normal growth behaviors. Each child will have their own growth cycle with different behaviors, but the core cognitive outline of the types of objectives, characteristics, and language growth will be the same for how they pass from one stage to the next.

Erikson's Life and Psychosocial Developmental Stages

Piaget's theories surmise how the evolution of motor and mental schemas help in the development of cognitive abilities of children. Erik Erikson, who developed a true lifespan model, describes the individualized social development of each individual while elaborating on the developmental stages that all humans encounter. He lived from 1902 to 1994. Today much of the psychosocial development for infants and children and, particularly, for tweens, teen and adults seem to be overlooked. The same virtues and developments are true now as during the time of Erikson. Therefore, a review of Erik Erikson's work is in order.

As with Piaget in the previous chapter, we'll first take a quick look at Erikson's life and work and then turn our attention to his eight psychosocial developmental stages: trust versus mistrust, autonomy versus shame, initiative versus guilt, industry versus inferiority, identity versus role confusion, intimacy versus stagnation, and ego integrity versus despair.

Erikson and His Work

Erik's mother, Karla Abrahasen, was Jewish, and it is believed that she was separated from her husband, Vlademar Isidor Salomonsen, when she found out she was pregnant with Erik. Since she came from a prominent Jewish family in Copenhagen, Denmark, and Erik's father was not Jewish, Karla fled to Frankfort, Germany. It was there that Karla trained to be a nurse, and in 1902 Erik Salomonsen was born. The two moved to Karlsruhe, Germany, and in 1905 Erik's mother married Theodor Homburger, Erik's pediatrician. Erik's name was changed to Erik Homburger, and a few years later he was officially adopted by Theodor. As a child, Erik was told that Theodor was his real father, and later in life when he found out that his real father was not Theodor, he felt deceived. Erik had blond hair and blue eyes and seemed to have trouble adjusting to his community and surroundings.

Around 1927, Erik, who was an excellent art teacher, was hired by many affluent families in Germany to teach their children. Some of these families were close to Anna and Sigmund Freud. It was Anna Freud who, when she saw Erikson's skill working with children, encouraged him to study psychoanalysis at Vienna's Psychiatric Institute. At this time, Erik also studied the Montessori method with its focus on development.

In 1930 Erik married Joan Mowat Serson, a Canadian dancer and artist, and eventually converted to Christianity. In 1933, Erik moved with his wife and two children to the United States; he worked at the Massachusetts General Hospital and held a position at Harvard Medical School where he met psychologist Kurt Lewin and anthropologists Margaret Mead and Gregory Bateson, who influenced his life and theories. In 1936, Erik left Harvard and joined Yale University to work at the Institute of Social Relations and teach at the medical school. At Yale he studied for a year Sioux children at a South Dakota Indian reservation. This shows how rounded and culturally diverse Erickson's background was.

Erik moved to California in 1939 and changed his name at this time to Erikson. He taught at the University of California, Berkeley and San Francisco, and he worked with the Institute of Child Welfare. He continued his studies of Native American children as he worked with the Yurok tribe in California. In 1950, while at the University of California, Erickson wrote the book *Childhood and Society*. Later, in 1968, Erikson wrote the book *Identity Youth and Crisis* and explained the "identity crisis" in adolescents. He believed this stage was a crucial turning point in life, because an identity was formed at this stage.

Erikson returned to Boston, and he worked at Austen Riggs Center where his focus of attention was on emotionally challenged youth. This adolescence stage was also a powerful time in Erikson's life. Erikson's theories were motivated by his studies of anthropology and psychology, as well as his knowledge and understanding from working with children and their families in clinical, research, and natural settings.

Erikson's Psychosocial Development Stages

Erikson's stages of psychosocial development focus on central conflicts where children complete each stage individually and sequentially. Erikson believed that humans face generalized challenges at each stage throughout life, and how they respond to these challenges will determine how they will develop later in life. The following sections examine Erikson's eight psychosocial stages of development, while Table 7-1 provides a snapshot of them. The psychosocial crisis, approximate ages, virtue, and outcome will be highlighted in each section.

Table 7-1. Erickson's Stages of Psychosocial Development

Stages and Ages	Psychosocial Conflict	Focus	Virtue	Success	Failure
Stage 1 0–18 months old	Trust versus mistrust	Feeding and movement skills	Hope	Success leads to trust of the caregiver and an emotional foundation.	Failure leads to mistrust of the caregiver and could lead to poor emotional stability.
Stage 2 18 months–3 years old	Autonomy versus shame	Toilet training and play	Will	Success leads to a sense of personal control over physical skills and independence, which lead to feelings of autonomy.	Failure leads to feelings of shame, insecurity, and doubt.
Stage 3 3–5 years old	Initiative versus guilt	Exploration and control	Purpose	Success leads to children asserting control and initiative over the environment, and they may need a balance of initiative and guilt to develop a conscience.	Failure leads children who try to exert too much initiative to experience disapproval, resulting in a sense of guilt for natural curiosity.

(continued)

Table 7-1. (continued)

Stages and Ages	Psychosocial Conflict	Focus	Virtue	Success	Failure
Stage 4 6–12 years old	Industry versus inferiority	School and friends	Competence	Success leads to a feeling of social and academic competence. Some failure is necessary for modesty.	When children fail and do not get encouragement from their role model, it results in feelings of inferiority or low self-esteem.
Stage 5 12–18 years old	Identity versus role confusion	Personal social relationships	Fidelity	Success leads to the ability of teens to develop a sense of self and personal identity.	Failure leads to role confusion and a weak sense of self.
Stage 6 18–40 years old	Intimacy versus isolation	Relationships	Love	Success leads young adults to build strong relationships and to form intimate, loving relationships with other people.	Failure results in loneliness and isolation.
Stage 7 40–65 years old	Generativity versus stagnation	Work and parenthood	Care	Success leads adults to feel useful and accomplishment and to create or nurture children or create a positive change situation that benefits other people.	Failure results in shallow involvement in the world.
Stage 8 65–death	Ego integrity versus despair	Reflection on life	Wisdom	Success at this stage for seniors is the need to look back on life and feel a sense of fulfillment.	Failure results in regret, bitterness, and despair.

Stage 1: Trust vs. Mistrust

Trust versus mistrust covers birth to 18 months. The focus of this stage is that infants are totally dependent on the caregiver and look to their caregivers for stability and consistency of care as the infants are uncertain about the world around them. Infants cannot use words at this stage and show their feelings through crying, cooing, and body language. The outcome of success at this stage is that when the parents are consistent and reliable, the children develop a trust, and they will be able to feel secure in other relationships even in threatening situations. The virtue is hope. In other words, infants develop a sense of trust, and this will carry them later in life to believe that others will be there for them as a source of support. Failure at this stage causes infants to mistrust. They will be suspicious and anxious, and infants will not have confidence in the world around them, and they will not have trust to influence events around them. In turn, infants will have fear and mistrust in their relationships, and they will feel anxious and insecure about the world around them.

Stage 2: Autonomy vs. Shame and Doubt

Autonomy versus shame and doubt covers the ages 18 months to three years. The focus of this stage is that as children develop physically and become more mobile, they develop a sense of control over their physical skills and a sense of independence that they have many skills and abilities. The parents' role is delicate at this stage because they need to encourage children to become more independent, and at the same time they have to be careful in their criticism when children have an accident or fail at an activity. It is important to allow children to explore their abilities in a supportive environment.

Children at this stage will be putting on their clothes and shoes and playing with toys. The child will learn how to walk away from his parents, and the child will decide which toys to play with as well as what food to eat and what clothes to wear. This allows a child to feel a sense of independence and autonomy. The outcome of success is when children are encouraged and supported, they will feel more confident and secure in their own abilities. The virtue is will, and it is the will to explore and assert themselves. Failure for children, at this point, is when children are criticized and controlled when they try to assert themselves. Children will feel inadequate, and children may develop lack of self-esteem and dependency, in other words, a sense of shame and doubt in themselves.

Stage 3: Initiative vs. Guilt

Initiative versus guilt covers the ages from 3 to 5 years. The focus of this stage is that children start to play games with other children as they start to attend school. This active interaction with other children is a period of rapid development, and children by way of interacting with other children explore ways to act and respond to other children. Children will do this by playing games, initiating activities, or planning activities. Children will ask many questions at this stage, and parents need to respond in a way so that children do not feel it is a nuisance, trivial, or embarrassing. The success at this stage is that children will have a balance between initiative and guilt. Children need to believe that they can directly respond in play and social interactions by themselves, but they must also develop a conscience and know how to exercise control. The virtue at this stage is purpose. Children will develop empathy, humor, and resilience at this stage. Failure at this stage is when children feel too much guilt when acting with others, which will inhibit their creativity.

Stage 4: Industry vs. Inferiority

Industry versus Inferiority covers the ages of 6 to 12. The focus of this stage is that school has a greater importance in children's lives, and teachers start to take an important role in children's life as they teach them skills. Children start to learn how to read and write and calculate arithmetic problems. Children start to do more on their own at this stage. At this stage children develop peer groups that will be a major source of children's self-esteem and will gain more importance and significance in their lives.

Success at this stage is that as children succeed in their studies and are encouraged, they will feel competent, industrious, and confident in their abilities to achieve their goals. To endure modesty, some failure is necessary to balance it all out. The virtue is competence. Children will have humility and the ability to accept the course of his own initiative. Failure is when children do not receive the support from their parents and teachers or role models; they will start to feel doubt and inferiority in their abilities, and this could stunt them in their potential to achieve their goals.

Stage 5: Identity vs. Role Confusion

Identity versus role confusion covers the ages of 12 to 18. The focus of this stage is on an adolescent's search for their personal identity and who they are and where they stand among others by vocalizing and displaying their personal values, beliefs, and goals. The adolescent, which is between childhood and adulthood, will examine and re-examine their independence of who they are

sexually and occupationally, and they will start to learn where they identify in the society around them. They start to search for the roles they will play in society and what their psychosocial world of family, friends, and other relationships will be like when they are adults. It is very important to note that the body has major biological and chemical changes at this time that affect the body and the body image of the adolescent. The adolescent at this stage may feel uncomfortable with their body image until they grow into it. This is a sensitive stage according to Erikson because it also affects the morality children feel and the ethics they will develop in adulthood.

The success during this stage is that the adolescent will explore other points of view and then determine where they feel comfortable within society. The virtue is fidelity or where they feel mastery, homage, and allegiance. The failure at this stage may be role confusion, which is the adolescent may be confused about how they fit in society, and they experience an identity crisis. This role confusion is where they may experiment with negative work, politics, and educational activities when they are unhappy, which creates a negative identity.

Stage 6: Intimacy vs. Isolation

Intimacy versus isolation covers the ages 18 to 40. The focus of this stage is for the young adult to experience harmony and conflicts in establishing intimacy with loving partners and other people in general. Long-term relationships continue to be established and re-established at this time where the young adult starts to become more intimate with others.

The success at this stage is a happy and committed relationship with a feeling of safety and care. The virtue at this stage is love, including being able to show love and tenderness freely. The failure is when a young adult avoids intimacy and has a fear of commitments. This may cause the young adult to experience isolation, which may lead to depression.

Stage 7: Generativity vs. Stagnation

The seventh stage's psychosocial conflict is generativity versus stagnation and includes ages from 40 to 65. The focus of this stage is that adults have the ability to care for and to be concerned about others. Adults will be raising their children, engaging in community activities and organizations, and working in rewarding and productive occupations. The adult will see the bigger picture in life and what life has to offer.

The success at this stage is when the adult is successfully able to give back, and the adult will feel useful, needed, and accomplished. The virtue at this stage is care, and the adult will be able to care for others and sympathize and

empathize with their other concerns. The failure is that when adults do not feel they are productive or accomplished, they may be stagnant and have a shallow sense of the world.

Stage 8: Ego Integrity vs. Despair

Ego Integrity versus despair covers the age 65 to death. The focus of this stage for senior citizens or just older adults is slowing down and pondering their accomplishments and failures. There is a complexity between the sense of integrity and the disintegration of the body.

The outcome of success will be integrity if the adult has achieved their goals in life. The wise senior citizen will feel a balance between integrity and despair. They will be able to look back at their lives with a wholeness and with a sense that they achieved meaningful accomplishments. The virtue at this stage is wisdom, being able to, with sensitivity and insight, see and understand the paths of others. The failure is that a senior citizen may look back on their lives and regret not working harder to achieve their goals. They may experience bitterness and hopelessness to the point of feeling depressed.

In essence, unlike Piaget's theory, Erikson's theory is a true lifespan approach. Together they encompass cognitive and psychosocial development from infancy to adulthood.

Summary

Like Piaget, Erikson is a pioneer in the field of developmental theory, and his theories have withstood time and the evolution of societal growth, which will discussed in Part III of this book. Psychosocial development of conflict, focus, success, and failure at each stage is pertinent and can add clarity to understanding how a person throughout their life will deal with the virtues at each stage. Like Piaget's cognitive development, Erikson's insights are invaluable even today to show how healthy and normal psychosocial development can help a person develop solid core virtues. Again, like Piaget, Erikson realized that each child will have their own growth cycle with different virtues, but the core psychosocial outline will be the same for how they pass from one stage to the next.

CDC and Medline Milestones and APA Factsheets Guidelines

This chapter will start by reviewing the U.S. National Library of Medicine (Medline) and the Center for Disease Control (CDC) developmental milestones, as well as the American Psychological Association (APA) developmental factsheets. The tables display the milestones of how babies and children learn to play, speak, act, and move.

We will then show how these charts support Piaget's cognitive developmental stages and Erickson's psychosocial developmental stages. The Medline and CDC milestones and APA factsheets will be reviewed, and the stages of development of Piaget and Erikson will be restated in order for you to make comparisons.

Some of the tables also talk about how to think of games your children would like to play and how to share and enjoy time with your children by doing some activities together. What are the activities your children like to do? Be conscious and alert if your child is doing something that concerns you at each stage and their growth pattern does not look right or if they are gaining skills at a faster or slower pace than expected. And always be cognizant if your children have other medical or behavioral needs. The APA details development factsheets of mental and social development up to the age of 10, as well as tips for handling difficult situations that may happen.

We start with the behavioral charts of Medline that show what infants, children, and adolescents should be learning at each milestone; after the tables, there will be a discussion on Piaget's and Erikson's theories. As intimated in the previous chapters, Piaget and Erikson went further in their theories of cognitive and psychosocial development than many of these milestone and factsheets.

Medline Age-Appropriate Developmental Milestones

Table 8-1 lists how these milestones evolve from infancy to adolescent.

Table 8-1. Medline Age-Appropriate Developmental Milestones

Age	Developmental Milestones
Infancy: Ages birth to 1 year	• Able to drink from a cup
	• Able to sit alone, without support
	• Babbles
	• Displays social smile
	• Gets first tooth
	• Plays peek-a-boo
	• Pulls self to standing position
	• Rolls over
	• Says "mama" and "dada," using terms appropriately
	• Understands "no" and will stop activity in response
	• Walks while holding on to furniture or other support
Toddler: Ages 1 to 3 years	• Able to feed self neatly, with minimal spilling
	• Able to draw a line (when shown one)
	• Able to run, pivot, and walk backwards
	• Able to say first and last names
	• Able to walk up and down stairs
	• Begins pedaling tricycle
	• Can name pictures of common objects and point to body parts
	• Dresses self with only a little bit of help
	• Imitates speech of others, "echoes" word back
	• Learns to share toys (without adult direction)
	• Learns to take turns (if directed) while playing with other children
	• Masters walking
	• Recognizes and labels colors appropriately
	• Recognizes differences between males and females
	• Uses more words and understands simple commands
	• Uses spoon to feed self

Table 8-1. (continued)

Age	Developmental Milestones
Preschool: Ages 3 to 6 years	• Able to draw a circle and square • Able to draw stick figures with two to three features for people • Able to skip • Balances better; may begin to ride a bicycle • Begins to recognize written words; reading skills start • Catches a bounced ball • Enjoys doing most things independently, without help • Enjoys rhymes and word play • Hops on one foot • Rides tricycle well • Starts school • Understands size concepts • Understands time concepts
School-Age Child: Ages 6 to 12 years	• Begins gaining skills for team sports such as soccer, T-ball, or other team sports • Begins to lose "baby" teeth and get permanent teeth • Girls begin to show growth of armpit and pubic hair, breast development • Menarche (first menstrual period) may occur in girls • Peer recognition begins to become important • Reading skills develop further • Routines important for daytime activities • Understands and is able to follow several directions in a row
Adolescent: Ages 12 to 18 years	• Adult height, weight, sexual maturity • Boys show growth of armpit, chest, and pubic hair; voice changes; testicles/penis enlarge • Girls show growth of armpit and pubic hair; breasts develop; menstrual periods start • Peer acceptance and recognition is of vital importance • Understands abstract concepts

CDC Age-Appropriate Developmental Milestones

Table 8-2 lists how the CDC development evolves from infancy to 5 years.

Table 8-2. CDC Age-Appropriate Developmental Milestones

Milestones at 2 months	What do most babies do at this age?
Social/emotional	• Calms down when soothed or picked up
	• Looks at your face
	• Seems happy to see you
	• Smiles when you talk to or smile at baby
Language/communication	• Makes sounds other than crying
	• Reacts to loud noises
Cognitive (learning, thinking, problem-solving)	• Watches you as you move
	• Looks at the toy for several seconds
Movement/physical development	• Holds head up when on tummy
	• Moves both arms and legs

Milestones at 4 months	What do most babies do at this age?
Social/emotional	• Smiles to get your attention
	• Chuckles (not yet a full laugh) when you do something funny
	• Looks at you, moves, or makes sounds to get or keep your attention.
Language/communication	• Makes sounds like "oooo" and "aahh" (cooing)
	• Makes sounds back when you talk
	• Turns head toward the sound of your voice
Cognitive (learning, thinking, problem-solving)	• If hungry, opens mouth when sees breast or bottle
	• Looks at hands with interest
Movement/physical development	• Holds head steady without support when being held
	• Holds a toy when you put it in their hand
	• Uses arm to swing at toys
	• Brings hand to mouth
	• Pushes up onto elbows/ forearms when on tummy

Table 8-2. (continued)

Milestones at 6 months	What do most babies do at this age?
Social/emotional	• Knows familiar people
	• Likes to look in the mirror
	• Laughs
Language/communication	• Takes turns making sounds with you
	• Blows "raspberries" (sticks tongue out and blows)
	• Makes squealing noises
Cognitive (learning, thinking, problem-solving)	• Puts things in mouth to explore them
	• Reaches to grab a toy
	• Closes lips to show doesn't want more food
Movement/physical development	• Rolls from tummy to back
	• Pushes up straight arms when on tummy
	• Leans on hands for support while sitting

Milestones at 9 months	What do most babies do at this age?
Social/emotional	• Is shy, clingy, or fearful around strangers
	• Shows several facial expressions, like happy, sad, angry, and surprised
	• Looks when you call name
	• Reacts when you leave (looks, reaches for you, and cries)
	• Smiles or laughs when you play peek-a boo
Language/communication	• Makes different sounds like "mamamama" and "babababa"
	• Lifts arms up to be picked up
Cognitive (learning, thinking, problem-solving)	• Looks for object when dropped out of sight
	• Bangs two things together
Movement/physical development	• Gets to a sitting position on own
	• Moves things from one hand to other hand
	• Uses fingers to "rake" food
	• Sits without support

Table 8-2. (continued)

Milestones at 12 months	What do most babies do at this age?
Social/emotional	• Plays games with you, like pat-a-cake
Language/communication	• Waves "bye-bye"
	• Calls a parent "mama" or "dada" or another special name
	• Understands "no" (pauses briefly or stops when you say it)
Cognitive (learning, thinking, problem-solving)	• Puts something in a container, like a block in a cup
	• Looks for things that you hide, like a toy under a blanket
Movement/physical development	• Pulls up to stand
	• Walks, holding on to furniture
	• Drinks from a cup without a lid, as you hold it
	• Picks things up between thumb and pointer finger, like small bits of food

Milestones at 15 months	What do most babies do at this age?
Social/emotional	• Copies other children while playing, like taking toys out of a container when another child does
	• Shows you an object they like
	• Claps when excited
	• Hugs stuffed doll or other toy
	• Shows you affection (hugs, cuddles, or kisses you)
Language/communication	• Tries to say one or two words besides "mama" or "dada" like "ba" for ball or "da" for dog
Cognitive (learning, thinking, problem-solving)	• Tries to use things the right way, like a phone, cup, or book
	• Stacks at least two small objects, like blocks
Movement/physical development	• Takes a few steps
	• Uses fingers to feed self some food

Table 8-2. (continued)

Milestones at 18 months	What do most babies do at this age?
Social/emotional	• Moves away from you, but looks to make sure you are close by
	• Points to show you something interesting
	• Puts hands out for you to wash them
	• Looks at a few pages in a book with you
	• Helps you by pushing arm through sleeve or lifting up foot when getting dressed
Language/communication	• Tries to say three or more words besides "mama" or "dada"
	• Follows one-step directions without gestures, like giving you the toy when you say, "Give it to me"
Cognitive (learning, thinking, problem-solving)	• Copies you doing chores, like sweeping with a broom
	• Plays with toys in a simple way, like pushing a toy car
Movement/physical development	• Walks without holding on to anyone or anything
	• Scribbles
	• Drinks from a cup but may spill sometimes
	• Feeds herself with her fingers
	• Tries to use a spoon
	• Climbs on and off a couch or chair without help

Milestones at 2 years	What do most babies do at this age?
Social/emotional	• Notices when others are hurt or upset, like pausing or looking sad when someone is crying
	• Looks at your face to see how to react in a new situation
Language/communication	• Points to things in a book when you ask, like "Where is the bear?"
	• Says at least two words together, like "More milk"
	• Points to at least two body parts you ask to show you
	• Uses more gestures than just waving and pointing, like blowing a kiss and nodding yes
Cognitive (learning, thinking, problem-solving)	• Holds something in one hand while using the other hand; for example, holding a container and taking the lid off
	• Tries to use switches, knobs, or buttons on a toy
	• Plays with more than one toy at the same time, like putting toy food on a toy plate

Table 8-2. (continued)

Milestones at 2 years	What do most babies do at this age?
Movement/physical development	• Kicks a ball • Runs • Walks (not climbs) up a few stairs with or without help • Eats with a spoon

Milestones at 30 months	What do most babies do at this age?
Social/emotional	• Plays next to other children and sometimes plays with them • Shows you something by saying "Look at me!" • Follows simple routines when told, like helping to pick up toys when you say, "It's cleanup time"
Language/communication	• Says about 50 words • Says two or more words, with one action word, like "Doggie run" • Names things in a book when you point and ask, "What is this?" • Says words like "I," "me," or "we"
Cognitive (learning, thinking, problem-solving)	• Uses things to pretend, like feeding a block to a doll as if it were food • Shows simple problem-solving skills, like standing on a small stool to reach something • Follows two-step instructions like "Put the toy down and close the door" • Show he knows at least one color, like pointing to a red crayon when you ask, "Which one is red?"
Movement/physical development	• Uses hands to twist things, like turning doorknobs or unscrewing lids

(continued)

Table 8-2. (continued)

Milestones at 3 years	What most children do at this age?
Social/emotional	• Calms down within 10 minutes after you leave her, like at a childcare drop-off
	• Notices other children and joins them to play
Language/communication	• Talks with you in conversation using at least two back-and-forth exchanges
	• Asks "who," "what," "where," or "why" questions, like "Where is mommy/daddy?"
	• Says what action is happening in a picture or book when asked, like "running," "eating," or "playing"
	• Says first name, when asked
	• Talks well enough for others to understand, most of the time
Cognitive (learning, thinking, problem-solving)	• Draws a circle, when you show him how
	• Avoids touching hot objects, like a stove, when you warn her
Movement/physical pevelopment	• Strings items together, like large beads or macaroni
	• Puts on some clothes, like loose pants or a jacket
	• Uses a fork

Milestones at 4 years	What most children do at this age?
Social/emotional	• Pretends to be something else during play (teacher, superhero, dog)
	• Asks to go play with children if none are around, like "Can I play with Alex?"
	• Comforts others who are hurt or sad, like hugging a crying friend
	• Avoids danger, like not jumping from tall heights at the playground
	• Likes to be a "helper"
	• Changes behavior based on location (places of worship, library, playground)
Language/communication	• Says sentences with four or more words
	• Says some words from a song, story, or nursery rhyme
	• Talks about at least one thing that happened during his day, like "I played soccer"
	• Answers simple questions like "What is a coat for?" or "What is a crayon for?"

Table 8-2. (continued)

Milestones at 4 years	What most children do at this age?
Cognitive (learning, thinking, problem-solving)	• Names a few colors of items
	• Tells what comes next in a well-known story
	• Draws a person with three or more body parts
Movement/physical development	• Catches a large ball most of the time
	• Serves himself food or pours water, with adult supervision
	• Unbuttons some buttons
	• Holds crayons or pencil between fingers and thumb (not a fish)

Milestones at 5 years	What most children do at this age?
Social/emotional	• Follows rules or talks turns when playing games with other children
	• Sings, dances, or acts for you
	• Does simple chores at home, like matching socks or clearing the table after eating
Language/communication	• Tells a story she heard made up with at least two events
	• Answers simple questions about a book or story after you read or tell it
	• Keeps a conversation going with more than three back-and-forth exchanges
	• Uses or recognizes simple rhymes (bat-cat, ball-tall)
Cognitive (learning, thinking, problem-solving)	• Counts to 10
	• Names some numbers between 1 and 5 when you point to them
	• Uses words about time, like "yesterday," "tomorrow," "morning," or "night"
	• Pays attention for 5 to 10 minutes during activities, for example, during story time or making arts and crafts (screen time does not count)
	• Write some letters in name
	• Names some letters when you point to them
Movement/physical development	• Buttons some buttons
	• Hops on one foot

American Psychology Association Developmental Factsheets

Tables 8-3 through 8-6 highlight the cognitive and social skills to expect from birth to 10 years old.

Table 8-3. Cognitive and Social Skills to Expect at 0 - 18 Months

Mental Skills
• Remember people and objects that are not present.
• Imitate other people's facial expressions, sounds, and actions.
• Imitate what they see on TV, even if they don't understand what they are doing.
• Understand what they hear before they can speak.
• Make noises to communicate with others and to show satisfaction or displeasure.
• Recognize their own name.
• Begin to explore the environment; touch and manipulate objects.
• Learn by imitating and observing other people.
• Show understanding of words for highly familiar objects.
• Understand about a dozen common phrases.
• Begin to use "me," "I," and "you."
• Understand and can follow very simple instructions.
• Have very short attention spans.

Social Skills
• Cry and flail arms and legs when in pain, tired, hungry, cold, thirsty, wet, lonely, or in a new situation and/or with new people.
• Smile, babble, and coo to show pleasure, joy, and excitement.
• Recognize the difference between familiar people and strangers.
• Develop strong bonds with people regularly caring for them, such as a parent or other adult, and show anxiety when separated.
• Are friendly to familiar people and afraid of strangers.
• Recognize distress of others by showing distress and crying.
• Enjoy audiences and applause.
• Can play alone for brief periods of time.
• Become angry when frustrated.
• Are afraid of strangers and are wary of unexpected situations.

(continued)

Table 8-3. (continued)

Tips for Parents

- If your baby is distressed and cries, comfort them. This will not spoil your child. When babies cry, they need warm and gentle responses to feel secure and safe. This trust forms the foundation for your future relationship with your child.
- Don't punish a crying baby. Be patient; your baby is just trying to tell you that something is wrong. Harsh responses will frighten a baby and make things worse.
- Play with your child every day. Make fun playtime part of your time together.
- Provide toys that are designed for your child's age and are safe.
- Talk frequently to your child; use simple direct words and give positive instructions. (Say "Let's play with the rattle" instead of "Don't play with the fork!")
- Read simple books to your child every day, including those with familiar objects to stimulate language and communication.
- If possible, reduce separations, or always have a familiar person caring for your child.
- Create and maintain daily routines to help your baby feel secure and build trust.

Table 8-4. Cognitive and Social Skills to Expect 18 to 36 Months

Mental Skills

- Have mental images of people and objects that are not present.
- Can use imagination and begin to play pretend games.
- Use an object to represent a person, like a doll to represent a mother or a child.
- Recount events of the day and imitate actions and events that occurred in the past.
- Has a vocabulary of several hundred words; can use two- to three-word sentences; repeat words.
- Listen to stories for a short period of time.
- Understand that images and pictures represent real objects and people.
- Have a vague notion of time; still confuse the meanings of today, tomorrow, and yesterday.
- Generally have short attention spans and can be easily distracted.
- Are just beginning to remember rules and don't really understand right from wrong.

Table 8-4. (continued)

Social Skills

- Are developing a strong sense of themselves as separate individuals.
- Think they are the center of the world.
- Beginning to show signs of independence; can be stubborn and contrary and say "no" to adults.
- Are possessive, with strong notions of territory: "This is mine!" Have difficulty sharing.
- May be having trouble waiting and want things right now.
- Have trouble expressing emotions with words; when frustrated or angry can have tantrums or hit and kick to get what they want.
- Play side by side with others more than cooperatively with them.
- Begin to understand that other people have expectations of them.
- Are more aware of feelings of others; enjoy adult attention.
- Express their feelings through pretend play/make-believe play.

Tips for Parents

- It is hard for children of this age to share things and take turns.
- The best way to deal with disputes over toys is to have more than one toy for them.
- Children of this age are always busy and often cannot do the same thing for long periods of time. Do not expect them to be happy in a place (church, grocery store) or situation (family dinners) or playing with the same toy or the same children for more than a half-hour or so without your support and attention.
- When children fight over the same toy, teach positive and nonviolent solutions: (1) provide another toy or remove the toy; (2) if that doesn't work, redirect children's attention to something else or take them to another place. Always make it clear that hurting another child is not acceptable.
- Always help your child resolve conflicts by using words to express what is happening ("You want to play with the car and Joanna is playing with the car? Tell her, 'I want the car'").
- Tantrums are typical of this age, but when they happen:

  (a) Remain calm; use a few gentle words to calm or distract your child.(b) Don't yell or hit your child.(c) Don't try to talk or teach in the middle of a tantrum.(d) Give little attention or ignore.(e) Shift your child's attention to something else.(f) Stand firm; don't give in to tantrums; try never to reward a tantrum.(g) Try to understand the causes.
- Adults should try to save saying "no" for situations involving safety and emotional well-being. In other situations, give choices.

Table 8-5. Cognitive and Social Skills to Expect from 3 to 5 Years

Mental Skills
• Can think about objects, people, and events without seeing them.
• Although less than before, still think they are the center of the world and have trouble seeing things from someone else's perspective.
• More able to use words to express thoughts and feelings and to share experiences.
• Talk to themselves out loud as a way to control their behaviors.
• Can think of events in the past or those yet to happen.
• Begin to think ahead and plan their actions; often can anticipate physical consequences of actions that are not too complicated.
• Starting to see the difference between things they see and what they really are (a stuffed dog is not a dog).
• Starting to see the relationship of cause and effect ("If I do this, then that will happen").
• Ask a lot of why, how, when questions.
• Learn by imitation, observation, and exploring, creating, and doing things.
• Understand that breakfast is before lunch, lunch is before dinner, etc.
• Begin to understand before/after, up/down, over/under, today/yesterday/tomorrow.
• Can't play or do something for too long or become bored and tired unless there is adult guidance.

Table 8-5. (continued)

Social Skills

- Can read and interpret emotions of others; can tell when someone is angry or upset.
- Can't understand abstract emotions like pity, greed, gratitude.
- Use different ways to control their own emotions: close their eyes and ears; remove themselves from the situation; sometimes can resist temptation to respond to whatever is disturbing them.
- May develop first true relationship because friends become very important.
- How they play: At age 3, they typically play near a friend and find it difficult to take turns and to share things; at age 4, they may begin cooperative play, still difficult to share but begin to understand turn-taking, begin to offer things to others; at age 5, enjoy playing with other children, often cooperate well, have special friends.
- Use less physical aggression than when younger.
- Use more frequent verbal aggression like insults, threats, or teasing to hurt other children; bullying appears; they understand the power of rejection.
- Understand social rules and can act in accordance to them.
- Are eager to carry out some responsibilities; offer to help.
- Understand that praise or blame happens because of what they do.
- Begin to understand the difference of doing things "on purpose" and "by accident"; focus more on the damage than on the intentions of the perpetrator.
- By age 4, begin to have a sense of their ethnic identity and of the ways their social group is perceived in the society.
- Increased capacity to use imagination; can imagine terrible things can happen to them, which can lead to fear; nightmares can happen.

Tips for Parents

- Teach your children to use words when they are angry or sad. ("You are sad because Grandpa is gone.")
- Ask your children to show angry, mad, sad, happy, and surprised feelings using their faces and tell you what makes people feel that way.
- Ask your children to draw a picture of their mad feelings and talk about them.
- Give your children opportunities to accomplish something like organizing toys and books, helping with making up the grocery list, delivering short messages to others, giving their own ending to a story in a book.
- Help your children cope with fantasy fear by pointing out the difference between reality and fantasy.
- Keep your children away from situations that create real fear such as seeing violence in the home or neighborhood, watching violence on TV, and receiving physical punishment.
- When there is a fight, (a) stop the fighting; go first to the child that is injured to calm them. (b) Use time outs to calm down the child who is the aggressor (no more than one minute for each year of the child's age). (c) When both children are calm, talk to them and ask: What happened? What is each one feeling? Ask them to think of a solution; tell that it's OK to be angry or mad but not to hurt. (d) Praise both children for thinking of a solution. Remember to show your love and care even though you disapprove of their behavior.

Table 8-6. Cognitive and Social Skills to Expect from 6 to 10 Years

Mental Skills

• Become able to understand the viewpoint of others; are aware that others can have different thoughts.

  • Can focus on several aspects of a problem at a time.

  • Can concentrate on what they are doing for longer periods of time.

  • Increased problem-solving ability, but not yet like an adult.

  • Can think of simple plans before acting. For example, when inviting friends over to play, children can plan in advance what games they will play.

  • Can begin to understand time and the days of the week; by age 10, children can place events in time sequence.

  • Improved short- and long-term memory.

  • Can speak and also write; by age 10, children have a vocabulary of 20,000 words and learn an average of 20 new words a day; can also understand that a word may have different meanings.

  • Can communicate better and longer with others, express themselves, and understand things.

  • Can better understand and internalize moral rules of behavior (right/wrong; good/bad; wonderful/terrible).

  • Begin to understand that what is fair is related to merit: who works harder deserves special treat.

  • Are better able to empathize with other people and accept the idea of giving special consideration to those in greater need.

Social Skills

  • Are able to view themselves based on how they perform in school; capacity to make friends; and their physical appearance.

  • Understand they can feel two emotions at the same time (I like Jenny, but I hate how she talks to me).

  • Are intensely interested in peers; prefer same-sex friends; develop friendships marked by give and take, mutual trust, and shared experiences.

  • Feel that belonging and acceptance by peers is very important. (Children may look more for peers than to adults for gratification.)

  • Play is no longer just fantasy play where imagination is the key element; more often children choose rules-based games where the rules are the key element and winning the game is more frequently the objective.

  • Have great concern with justice and fairness; what is fair or equal is important, and some children may try to get even and become verbally or physically aggressive.

  • Continue to develop social skills like empathy and compassion.

  • Become more able to do things by themselves, and as a result, their relationship with parents changes.

Table 8-6. (continued)

Tips for Parents

- Help your children to develop a sense of competence: give them opportunities to master some skills like cooking, building models, making crafts, playing an instrument.
- Learn to gradually share the control of your child's life with them.
- Reinforce the understanding of right and wrong and consequences.
- Teach problem solving to your child. Use the IDEAL model to:
  - Identify the problem and the feelings involved (your child is being bullied and is afraid of going to school).
  - Determine with the child possible solutions without use of violence.
  - Evaluate with the child the merits of each possible solution.
  - Act, choosing the best solution.
  - Learn from what you and your child did to solve the problem.
- Use real-life situations (in your family or make up a situation), and when you are on the bus, in the car, or in the kitchen, play the IDEAL game with your child. A mock scenario could be: A child can't watch TV because they haven't done their homework and is mad and breaks the remote control.
- Reinforce prosocial skills such as sharing, empathy, and cooperation by asking a child to do things like help care for a baby or collect food for a shelter.
- Provide opportunities for your child to develop an understanding of rules by playing simple table games that rely on chance rather than on skills such as cards, dominoes, tic-tac-toe.
- Teach by speaking out loud to yourself (so your child will hear) about a problem and how to resolve it. An example: We are out of milk, bread, and fruit. I'm not feeling well. I will call Daddy and ask him to stop by the grocery store on his way home to get them.
- Demonstrate that behaviors and actions have consequences for everybody involved in a situation: if you do that, this will happen, or when you do this, then you will get this.

Milestones, Factsheets, and Developmental Theory Comparisons

As you will see in this section, there do not appear to be any discrepancies between the milestones of the Medline and CDC, APA Developmental Factsheets, and the theories and research of Piaget and Erikson. Examples will be shown at each stage. The detailed movements, language, cognition, movements, and social and emotional skills of the milestones and factsheets support the theories. The drawback is that the milestones and factsheets do not cover all the stages of development.

We will review the Medline and CDC milestones and APA Developmental Factsheets and then discuss Piaget's and Erikson's stages.

Piaget's Stages of Cognitive Development

Medline Sensorimotor Stage (Birth to 24 Months)

Medline states this milestone of infancy is between the ages of birth to 1 year. For the infancy stage, some of the milestones are that the infant babbles, walks while holding on to furniture or another support, is able to drink from a cup, and is able to sit alone, without support.

CDC Sensorimotor Stage (Birth to 24 Months)

Here are the CDC milestones at 2 months:

> Language/communication: The baby makes sounds other than crying; reacts to loud noises.

> Cognitive: Watches you as you move; looks at the toy for several seconds.

> Movement/physical development: Holds head up when on tummy; moves both arms and legs.

Here are the CDC milestones at 4 months:

> Language/communication: Makes sounds like "oooo" and "aahh" in cooing; makes sounds in response to voices; turns head toward the sound of your voice.

> Cognitive: If hungry, opens mouth when sees breast or bottle; looks at hands with interest.

> Movement/physical development: Holds head steadily without support when being held; holds a toy when you put it in infant's hand; uses arms to swing at toys; brings hands to mouth; pushes up onto elbows/forearms when on tummy.

Here are the CDC milestones at 6 months:

> Language/communication: Takes turns making sounds with you; blows "raspberries" (sticks tongue out and blows); makes squealing noises.

> Cognitive: Puts things in mouth to explore them; reaches to grab a toy; closes lips to show doesn't want more food.

Movement/physical development: Rolls from tummy to back; pushes up straight arms when on tummy; leans on hands for support while sitting.

Here are the CDC milestones at 9 months:

Language/communication: Makes different sounds like "mamamama" and "babababa"; lifts arms up to be picked up.

Cognitive: Looks for objects when dropped out of sight.

Movement/physical development: Gets to a sitting position on own; moves things from one hand to her other hand; uses fingers to "rake" food; sits without support.

Here are the CDC milestones at 12 months:

Language/communication: Waves "bye-bye"; calls a parent "mama" or "dada" or another special name; understands "no" (pauses briefly or stops when you say it).

Cognitive: Puts something in a container like a block in a cup; looks for things you hide like a toy under a blanket.

Movement/physical development: Pulls up to stand; walks holding on to furniture; drinks from a cup without a lid as you hold it; picks things up between thumb and pointer finger like small bits of food.

Here are the CDC milestones at 15 months:

Language/communication: Tries to say one or two words besides "mama" or "dada" like "ba" for ball or "da" for dog.

Cognitive: Tries to use things the right way, like a phone, cup, or book; stacks at least two small objects, like blocks.

Movement/physical development: Takes a few steps on own; uses finger to feed self some food.

Here are the CDC milestones at 18 months:

Language/communication: Tries to say three or more words besides "mama" or "dada"; follows one-step directions without gestures, like when you say, "Give it to me."

> Cognitive: Copies you doing chores, like sweeping with a broom; plays with toys in a simple way like pushing a toy car.
>
> Movement/physical development: Walks without holding on to anyone or anything; scribbles.

APA Sensorimotor Stage (Birth to 24 Months)

Here are the APA Developmental Factsheets cognitive (mental) skills from 0 to 18 months:

> Child can remember people and objects who are not present; imitate other people's facial expressions, sounds, and actions; imitate what they see on TV, even if they don't understand what they are doing; understand what they hear before they can speak; make noises to communicate with others and to show satisfaction or displeasure; recognize their own name; begin to explore the environment; touch and manipulate objects; learn by imitating and observing other people; show understanding of words for highly familiar phrases; begin to use "me," "I," and "you"; understand and can follow very simple instructions; have very short attention spans.

According to Piaget, all these activities would fall in the sensorimotor stage because they show imitation activities and the infants learn and show pleasure and dislike by way of pushing, sucking and pulling, and using the movements of tasting, smelling, and listening to sounds. The infant experiences by using motor activity without using symbols. These experiences are learned through trial and error. As the infant gets older, the movements become more flexible.

Medline Preoperational Stage (2–7 Years)

Medline states toddlers are between 1 and 3 years old, and preschoolers are between the ages of 3 to 6 years. The toddler is able to feed themselves neatly, with minimal spilling; able to run, pivot, and walk backwards; able to say first and last name; and uses more words and understands simple commands.

The preschooler is able to draw a circle and a square, skip, begin to recognize written words, hop on one foot and understand size and time concepts.

CDC Preoperational Stage (2–7 Years)

Here are the CDC milestones at 2 years:

> Language/communication: Points to things in a book when asked, like "Where is the bear?"; says at least two words together like "More milk"; points to at least two body parts you ask; uses more gestures than just waving and pointing, like blowing a kiss and nodding yes.

> Cognitive: Holds something in one hand while using the other hand, for example, holding a container and taking the lid off; tries switches, knobs, or buttons on a toy; plays with more than one toy at the same time. Likes putting toy food on a toy plate.

> Movement/physical development: Kicks a ball; runs.

Here are the CDC milestones at 30 months:

> Language/communication: Says about 50 words; says two or more words together, with one action word, like "Doggie run"; names things in a book when you point and ask, "What is this?"; says words like "I," "me," or "we."

> Cognitive: Uses things to pretend, like feeding a block to a doll as if it were food; shows simple problems-solving skills, like standing on a small stool to reach something; follows two-step instructions like "Put the toy down and close the door"; knows at least one color, like pointing to a red crayon when you ask, "Which one is red?"

> Movement/physical development: Uses hands to twist things, like turning doorknobs or unscrewing lids.

Here are the CDC milestones at 3 years:

> Language/communication: Talks with you in conversation using at least two back-and-forth exchanges; asks "who," "what," "where," or "why" questions, like "Where is mommy/daddy?"; says what action is happening in a picture or book when asked, like "running," "eating," or "playing."

> Cognitive: Can draw a circle; avoids touching hot objects, like a stove, after a warning.

> Movement/physical development: Strings item together, like large beads or macaroni; puts on some clothes by himself, loose pants or a jacket; uses a fork.

Here are the CDC milestones at 4 years:

> Language/communication: Says sentences with four or more words; says some words from a song, story, or nursery rhyme; talks about at least one thing that happened during his day like "I played soccer"; answers simple questions like "What is a coat for?" or "What is a crayon for?"

> Cognitive: Names a few colors of items; tells what comes next in a well-known story; draws a person with three or more body parts.

> Movement/physical development: Catches a large ball most of the time; serves self food or pours water, with adult supervision; unbuttons some buttons; holds crayons or pencils between fingers and thumb.

Here are the CDC milestones at 5 years:

> Language/communication: Tells a story heard or made up with other children; answers questions about a book or story after you read or tell it to him; keeps a conversation going with three back-and-forth exchanges; uses or recognizes simple rhymes (bat-cat, ball-tall).

> Cognitive: Counts to 10; names some numbers between 1 and 5 when you point to them; uses words about time, like "yesterday," "tomorrow," "morning," or "night"; names some letters when you point to them.

> Movement/physical development: Buttons some buttons; hops on one foot.

APA Preoperational Stage (2–7 Years)

Here are the APA Developmental Factsheets cognitive (mental) skills for 18 to 36 months:

> Children have mental images of people and objects that are not present; use an object to represent a person, like a doll to represent a mother or a child; recount events of the day and imitate actions and events that occurred in the past; has a vocabulary of

> several hundred words; can use two- to three- word sentences; repeat words; listen to stories for a short period of time; understand that images and pictures represent real objects and people; have a vague notion of time; still confuse the meanings of "today," "tomorrow," and "yesterday"; generally have short attention spans and can be easily distracted; are just beginning to remember rules and don't really understand right from wrong.

Here are the APA Developmental Factsheets cognitive (mental) skills from 3 to 5 years:

> Can think about objects, people, and events without seeing them; although less than before, still think they are the center of the world and have trouble seeing things from someone else's perspective; more able to use words to express thoughts and feelings and to share experiences; talk to themselves out loud as a way to control their behaviors; can think of events in the past or those yet to happen; begin to think ahead and plan their actions; often can anticipate physical consequences of actions that are not too complicated; starting to see the difference between things they see and what they really are (stuffed dog in not a dog); starting to see the relationship of cause and effect ("If I do this, then that will happen"); ask a lot of why, how, when questions; learn by imitation, observation, and exploring, creating, and doing things; understand that breakfast is before lunch, lunch is before dinner, etc.; beginning to understand before/after, up/down, over/under; can't play or do something for too long or become bored and tired unless there is adult guidance.

According to Piaget, all these skills and activities would fall in the preoperational stage because they involve pretend play, unsocialized play, and egocentric language where they talk to themselves even in groups. The children start to develop memory and imagination during this stage.

Medline Concrete Operational Stage (7–11 Years)

Medline states that school age is between the ages of 6 to 10 years and is when children begin gaining skills for team sports such as soccer, T-ball, or other team sports. Reading skills develop further, and the child is able to understand and follow several directions in a row.

CDC Concrete Operational Stage (7–11 Years)

N/A CDC

APA Concrete Operational Stage (7–11 Years)

Here are the APA Developmental Factsheet's cognitive (mental) skills at 6 to 12 years:

> Children become able to understand the viewpoint of others; are aware that others can have different thoughts; can focus on several aspects of a problem at a time; can concentrate on what they do for longer periods of time; increased problem-solving ability, but not yet like an adult; can think of simple plans before acting. For example, when inviting friends over to play, children can plan in advance what games they will play; can begin to understand time and the days of the week; by age 10, children can place events in time sequence; improved short- and long-term memory; can speak and also write; by age 10, children have a vocabulary of 20,000 words and learn an average of 20 new words a day; can also understand that a word may have different meanings; can communicate better and longer with others, express themselves, and understand things; can better understand and internalize moral rules of behavior (right/wrong; good/ bad; wonderful/terrible); begin to understand that what is fair is related to merit: who works harder deserves special treat; are better able to emphasize with other people and accept the idea of giving special consideration to those in greater need.

According to Piaget, all these skills and activities would fall in the concrete operational stage because school-age children are able to perform mental thought in their minds and by the end of this stage are able to do math problems. There is a spurt in vocabulary growth at this time as well. They also apply less focus on themselves and are more socialized and play games with their peers. Also, there is a sense of time, space, and quantity. Conservation, reversibility, seriation, and classification appear at this stage but are concrete in nature, as described in the characteristic section of Piaget's research. As children play games and go to school, their vocabulary increases, they are more aware of their surroundings, and their concentration is better. Their thought process tends to be more flexible, and by then they can add, subtract, multiple and divide.

Medline Formal Operational Stage (11 and Up)

Medline states adolescence is between the ages of 12 and 18, and they are able to understand abstract thinking. Peer acceptance/recognition is of vital importance.

CDC Formal Operational Stage (11 and Up)

N/A CDC

APA Formal Operational Stage (11 and Up)

N/A APA

According to Piaget, at this stage all these skills and activities fall under the formal operational stage because there is abstract and logical reasoning, strategy planning, and moral thinking. The individuals collaborate with each other in a meaningful manner and have conversations about topics. At this stage, during arguments, they respond to opposition and factual reason and provide explanations with proof of why they disagree in the way they do.

Erikson's Stages Psychosocial of Development

Medline Stage 1: Trust vs. Mistrust (Birth to 18 Months)

Medline states this milestone of infancy as between birth and 1 year. Displays social smile; understands "no" and will stop activity in response.

CDC Stage 1: Trust vs. Mistrust (Birth to 18 months)

Here are the CDC milestones at 2 months:

> Social/emotional: Calms does when soothed or picked up; looks at your face; seems happy to see you; smiles when you talk or smile.

Here are the CDC milestones at 4 months:

> Social/emotional: Smiles on own to get your attention; chuckles (not yet when you try to make her laugh; looks at you, moves, or makes sounds to get or keep your attention.

Here are the CDC milestones at 6 months:

> Social/emotional: Knows familiar people; likes to look in the mirror; laughs.

Here are the CDC milestones at 9 months:

> Social/emotional: Is shy, clingy, or fearful around strangers; shows several facial expressions, like happy, sad, angry, and surprised; looks when you call name; reacts when you leave (looks, reaches for you, and cries); smiles or laughs when you play peek-a-boo.

Here are the CDC milestones at 12 months:

> Social/emotional: Plays games with you, like pat-a-cake.

Here are the CDC milestones at 15 months:

> Social/emotional: Copies other children while playing like taking toys out of a container when another child does; shows you an object she likes, claps when excited; hugs stuffed doll or other toy; shows you affection (hugs, cuddles, or kisses you).

APA Stage 1: Trust vs. Mistrust (Birth to 18 months)

Here are the APA Developmental Factsheet for social skills from 0 to 18 months:

> Cry and flail arms and legs when in pain, tired, hungry, cold, thirsty, wet, lonely or in a new situation and/or with new people; smile, babble, and coo to show pleasure, joy, and excitement; recognize the difference between familiar people and strangers; develop strong bonds with people regularly caring for them such as a parent or other adult and show anxiety when separated; are friendly to familiar people and afraid of strangers; recognize distress of others by showing distress and crying; enjoy audience and applause; can play alone for brief periods of time; become angry when frustrated; are afraid of strangers and are wary of unexpected situations.

According to Erikson, at this stage infants are totally dependent on the caregiver, and how the caregiver, usually the parent, interacts with the baby is of most importance for their social and emotional health. Since infants cannot use words to show how they feel, they do show the caretaker how they feel

through crying, cooing, and body movements. Erikson thought that if an infant shows it feels safe and secure in this world, then they will successfully develop a sense of trust. It is important for the caretaker to show consistency. It is important for the caretaker to show affection when the baby cries, and it is important for the caregiver to try to determine which needs of the infant need to be met. When the parent holds the baby closely during feeding, bathing, and comforting, then babies will feel secure, and this helps the infant develop the virtue of hope. Also, when children are fully fed and feel nourished, they may begin to develop trust. When the child is not dealt with in a consistent, secure manner, they may develop insecurity and distrust of the world around them.

Medline Stage 2: Autonomy vs. Shame (18 Months to 3 Years)

Medline states this milestone of infancy as between the ages of 1 and 3 years. The child learns to share toys (without adult direction) and learns to take turns (if directed) while playing with other children.

CDC Stage 2: Autonomy vs. Shame (18 Months to 3 Years)

Here are the CDC milestones at 18 months:

> Social/emotional: Moves away from you, but looks to make sure you are close by; points to show you something interesting; puts hands out for you to wash them; looks at a few pages in a book with your; helps you dress them by pushing arm through sleeve or lifting up foot.

Here are the CDC milestones at 2 years:

> Social/emotional: Notices when others are hurt or upset, like pausing or looking sad when someone is crying; looks at your face to see how to react in a new situation.

Here are the CDC milestones at 30 months:

> Social/emotional: Plays next to other children and sometimes plays with them; shows you what they can do by saying "Look at me!"; follows simple routines when told like helping to pick up toys when you say, "It's cleanup time."

Here are the CDC milestones at 3 years:

> Social/emotional: Calms down within 10 minutes after you leave her, like at a childcare drop-off; notices other children and joins them to play.

APA Stage 2: Autonomy vs. Shame (18 Months to 3 Years)

Here are the APA Developmental Factsheet's social skills from 18 to 36 months:

> Children are developing a strong sense of themselves as separate individuals; think they are the center of the world; beginning to show signs of independence; can be stubborn and contrary and say "no" to adults; are possessive, with strong notions of territory: "This is mine!" Have difficulty sharing; may be having trouble waiting and want things right now; have trouble expressing emotions with words; when frustrated or angry can have tantrums or hit and kick to get what they want; play side by side with others more than cooperatively with them; begin to understand that other people have expectations of them; are more aware of feeling of others; enjoy adult attention; express their feelings through pretend play/make-believe play.

According to Erikson, at this stage toddlers become more mobile and begin to assert their independence. At this time, the toddler has a need to show more control and independence over themselves as they explore their caretaker and the world around them. There are some tasks that are important during this stage that will help the toddler. Toilet training is of utmost importance because the toddler learns how to control their body functions and will develop the virtue of will. Toddlers like to pick out the clothes they wear at this stage and want more control over what they eat and what toys they play with. When the child develops successfully socially and emotionally, they feel more confident and secure in their abilities of self-control; if they fail, they develop self-doubt and possible inadequacy, are overdependent, will feel shame, and have a lack of self-esteem.

Medline Stage 3: Initiative vs. Guilt (4 to 5 Years)

Medline states this milestone is between 3 to 6 years old. The child starts school, rides a tricycle well, and enjoys doing most things independently, without help.

CDC Stage 3: Initiative vs. Guilt (4 to 5 Years)

Here are the CDC milestones at 4 years:

> Social/emotional: Pretends to be something else during play (teacher, superhero, dog); asks to go play with children if none are around, like "can I play with Alex?"; comforts others who are hurt or sad, like hugging a crying friend; avoids danger, like not jumping from tall heights at the playground; likes to be a "helper"; changes behavior based on location (places of worship, library, playground).

Here are the CDC milestones at 5 years:

> Social/emotional: Follows rules or takes turns when playing games with other children; does simple chores at home, like matching socks or clearing the table after eating.

APA Stage 3: Initiative vs. Guilt (4 to 5 Years)

Here are the APA Developmental Factsheet's social skills from 3 to 5 years old:

> Can read and interpret emotions of others; can tell when someone is angry or upset; can't understand abstract emotions like pity, greed, gratitude; uses different ways to control their own emotions such as closes their eyes and ears or removes themselves from the situation; sometimes can resist temptation to respond to whatever is disturbing them; may develop first relationship because friends become very important. At age 3, they typically play near a friend, but find it difficult to take turns and to share things. At age 4, they may begin cooperating play; it is still difficult to share but they begin to understand turn-taking and begin to offer things to others. At age

5, they enjoy playing with other children, often cooperate well, and have special friends; use less physical aggression than when younger; use more frequent verbal aggression like insults, threats, teasing to hurt other children; bullying appears; they understand the power of rejection; understand social rules and can act in accordance to them; are eager to carry out some responsibilities; offer to help; understand that praise or blame happens because of what they do; begin to understand the difference of doing things "on purpose" and "by accident"; focus more on the damage than on the intentions of the perpetrator. By age 4, they begin to have a sense of their ethnic identity and of the ways their social group is perceived in the society. Also, there is an increased capacity to use imagination; can imagine terrible things can happen to them and can lead to fear; nightmares can happen.

According to Erikson, at this stage, preschoolers begin to assert themselves more and are more active mostly by playing and interacting with others. At this time, the child begins to interact more with other children, and their playtime will give children the time to explore their social skills. The caregivers should encourage initiative by allowing the child to explore their world by undertaking and finishing tasks, facing challenging scenarios, and planning their own activities. These activities allow the preschooler to start to develop the virtue of purpose. The preschooler should be taught persistence and initiative during this time in order to have success. Encourage children to make safe choices within a secure and safe boundary, and they will develop a sense of purpose in this world.

It is imperative that the guardian is not too restrictive and demanding with criticisms and ridicule during this time or else the preschooler may develop guilt.

Medline Stage 4: Industry vs. Inferiority (6 to 12 Years)

Medline states this milestone of infancy is between the ages of 6 and 12 years. Children begin gaining skills for team sports such as soccer, T-ball, or others.

CDC Stage 4: Industry vs. Inferiority (6 to 12 Years)

CDC N/A

APA Stage 4: Industry vs. Inferiority (6 to 12 Years)

Here are the APA Developmental factsheet social skills from 6 to 10 years old:

> Children are able to view themselves based on how they perform in school, capacity to make friends, and their physical appearance; understand they can feel two emotions at the same time ("I like Jenny, but I hate how she talks to me"); are intensely interested in peers, prefer same-sex friends; develop friendships marked by give and take, mutual trust, and shared experiences; feel that belonging and acceptance by peers is very important (children may look more for peers than to adults for gratification); play is no longer just fantasy play where imagination is the key element; more often children choose rules-based games where the rules are the key element and winning the game is more frequently the objective; have great concern with justice and fairness; what is fair or equal is important, and some children may try to get even and become verbally or physical aggressive; continue to develop social skills like empathy and compassion; become more able to do things by themselves, and as a result, their relationship with parents changes.

According to Erikson, at this stage children are more affected by their peers at school and during social activities. During this time, children receive tasks, such as reading, writing, arithmetic, and problem solving. The virtue of confidence develops at this stage. Success occurs when they have a sense of confidence in what they accomplish and feel competent in what they value when they are given praise for what they are doing. Failure occurs when the parent over-praises their children and children learn unrealistic abilities. The parents should encourage children in areas where they may excel so that they feel confident in their abilities.

Medline Stage 5: Identity vs. Role Confusion (12 to 18 Years)

Medline states this milestone of infancy is between the ages of 12 to 18. Peer acceptance/recognition is of vital importance.

CDC Stage 5: Identity vs. Role Confusion (12 to 18 Years)

CDC N/A

APA Stage 5: Identity vs. Role Confusion (12 to 18 Years)

APA N/A

According to Erikson, at this stage, adolescents develop a sense of self by exploring their independence. Adolescents interact with friends, family, social groups, and societal trends, and they develop relationships that will characterize their growth. They will experiment with a variety of roles and behaviors and play in different activities. The adolescent will develop a sense of uniqueness, and this is how they can be differentiated from others. They have a sense of sameness about how they fit in the community with themselves and in interactions with others. They need mental and physical health as well. Success is that they develop a sense of fidelity with the ability to relate to others in making genuine relationships. The adolescent needs to feel independent by being encouraged to explore and then will feel more in control. Otherwise, they will fail and may become insecure and confused of their roles in the world. They need to feel more self-confident and have a sense of trust in their abilities, judgments, and thoughts. At this time, they will develop committed relationships, and they will explore career paths, social groups, and personal style. With failure the adolescent will have difficulty with commitment, develop a weak sense of self, and be emotionally and psychologically frail. With success, adolescence will develop a solid commitment, develop a strong sense of self, and be emotionally and psychologically fit. With success, the virtue of fidelity develops. Here, children accept and commit to others with similar and different ideologies. Otherwise, they could become rebellious and have difficulty with where they fit in society.

Medline Stage 6: Intimacy vs. Isolation (18 Years to 40 Years)

Medline N/A

CDC Stage 6: Intimacy vs. Isolation (18 Years to 40 Years)

CDC N/A

APA Stage 6: Intimacy vs. Isolation (18 Years to 40 Years)

APA N/A

According to Erikson, at this stage adults explore long-term relationships with others outside the family and form intimate relationships, in particular romantic and friendship relationships. These relationships with others are described as close, loving, and honest. Success at this stage leads to strong, fulfilling, deep, and meaningful relationships that are enduring. Supportive networks that are emotionally and mentally strong with a virtue of love are the key. Otherwise, failure at this stage, which is when there may be disruption in relationships, may lead to adults feeling isolated, depressed, and alone.

Medline Stage 7: Generativity vs. Stagnation (40–65 Years)

Medline N/A

CDC Stage 7: Generativity vs. Stagnation (40–65 Years)

CDC N/A

APA Stage 7: Generativity vs. Stagnation (40–65 Years)

APA N/A

According to Erikson, at this stage, adults during this time are getting married, raising families and parenting, working on their career path, and developing communities. The adult is part of a community. The events are less specific at

this time. The way to enhance generativity is through commitments with others, developing relationships with family and friends, mentoring, and giving to the next generation. Success is when you are able to give to others and the world, and failure is when you feel disconnected and not involved with your community and unproductive with no sense of how to give back to society.

Medline Stage 8: Ego Integrity vs. Despair (65–Death)

Medline N/A

CDC Stage 8: Ego Integrity vs. Despair (65–Death)

CDC N/A

APA Stage 8: Ego Integrity vs. Despair (65–Death)

APA N/A

According to Erikson, at this stage older adults become less active and productive in society, and they will look back at their lives and assess if it was meaningful. The senior adults will feel successful if they have succeeded by way of feeling accomplished and fulfilled. Success will be if they have less lack of regret and more feelings of peace and a sense of wholeness and worthiness. They will have a virtue of wisdom. Otherwise, they will be disappointed or have regret and shame of being unproductive during their life. Disruption during this stage of death of loved ones, retirement, and terminal illnesses may happen.

Summary

This chapter reviewed the behaviors that are associated with normal development at each stage outlined by the CDC, Medline, and APA. These organizations give details on cognitive, social, behavioral, and biological growth, while Piaget's and Erickson's research provides the theories on why these stages happen with details. The APA adds tips to help the parent get through difficult situations that children may encounter in their development.

It is now time to continue on the journey to understand how the stages are relevant and how children interact with modern-day smart and advanced technologies, which will be introduced in Part IV.

Developing a Framework for Using Technology in Today's World

Part IV reviews how to understand your family values and talk to children about them so that they know them and share in their making. The Harvard School of Education states that when young children start using smart devices, it is imperative to keep the conversation going so that children can comprehend the significance and drawbacks of these technologies. Using what we now know from the developmental psychologists covered earlier, this part will use Tom's Hardware's advice on age-specific technologies for children, along with Piaget's and Erikson's developmental stage criteria. Chapter 10 will cover symptoms that are prevalent in our society now, some of which are

thought to be related to screen time, according to the Mayo Clinic. However, there is no way to stop these artificial intelligence disruptions. In fact, more advanced technologies are being created every day that are even more disruptive. This book is a framework for how families, friends, teachers, and mentors can take some initiative to ready their children for the future in a nurturing, able, and competent manner. They need to keep in mind virtues and understand the values of technology while keeping a constructive ongoing conversation about it.

Guidelines for Giving Your Children Technology

Thus far, this book has reviewed the history of technological advances, given a synopsis of Piaget's and Erickson's developmental theories, and presented the Medline, CDC, and APA cognitive and social milestones and factsheets highlighting the most common movements children acquire at different stages. Now, it is now time to assess, in a general way, how and when to introduce infants, children, adolescents, and adults to texting, streaming, social media, and videos, in an age-appropriate manner, on computers and smart devices.

An article by the Harvard Graduate School of Education titled "When to Give Your Child a Smartphone" states, "Deciding when to get your child a smartphone has less to do with age and more to do with action on both the parent and child's part, according to experts."

The article continues saying, "Psychologist Catherine Steiner-Adair, author of *The Big Disconnect*, says the real question is not about the 'right' age or about the phone itself but about whether your child is developmentally ready to have 'full access to the adult world' and whether you've laid the groundwork to prepare them for healthy and responsible device use."

The article continues: "You know your child is ready for a device when you've talked about responsible use and modeled the behavior on your own device," says Kerry Gallagher, a digital learning specialist at St. John's Prep in Danvers, Massachusetts, and director of K-12 education at ConnectSafely.org. "If you haven't done any of this work, then it might make sense to wait another year." These are important statements that should be addressed.

This chapter will cover what age-appropriate time is ideal to introduce your children to technology. For the most part, we will give an overview of the situation. Children need to be ready to use the devices you give them. This book does not cover each technology individually or when to give children each gadget or media because for the most part it is thought that this is up to the parent, the child or the young adult, and the family unit to decide. Also, all technologies are constantly changing, and new inventions are coming onto the market every day. The parent or guardian should work with their children and young adults to develop age-appropriate moral guidelines and virtues that are understandable and within reasonable limits. As Kerry Gallagher states, the foundation needs to be established before introducing the technology.

Recognize and Identify Your Circle of Unity Values

Understand what your family values are and keep talking to your children about those values and virtues. Erik Erickson gives essential virtues that can be addressed at every stage of development.

First, it is essential to understand, talk about, and embrace your family values. Set aside some time to think about them by yourself and with your family so that the entire family can more or less define what they are and be active participants in creating them. Of course, as time goes by, values change, and people get older, so they should be assessed every now and again and adapted to age-appropriate ones. Erikson gives a good starting point for how to review these virtues at each stage. It is important to allot time and energy to understand what your families goals are and how they will add value to advance, at each stage of your children's development, their cognition and psychosocial development. Do not worry if there are differences in your family goals and opinions. Use this time as an exercise to understand what others are thinking and feeling and why they are thinking and feeling a certain way. This is one aspect of what Piaget called *abstract thinking*. At young ages,

it may be even more important to help your children to learn how to communicate using different modes so that they can express their feelings and competences at various stages as they develop.

Here are some ways to start thinking about your values help children to understand those values:

- Think of important values and virtues to you and your family.

- Think about advancing creativity in the family.

- Think about encouraging and showing sympathy, kindness, empathy, and responsibility in your household.

- Think about creating innovative ideas together and encouraging your children to develop ideas independently.

- Think about activities the family can do together and play together.

- Think about the quality of the media children are exposed to and the time spent on these technologies.

Decide which technologies will advance goals you have and how and why these technologies may do that.

Introducing smart device practices is the parents' and guardians' responsibility at first and can be treated as an opportunity to educate children's moral development. As the American Psychological Association (APA) says, children do not grow in a one-size-fits-all approach. Every family is unique and needs to allow themselves space and time to decide which technology to let their children use, and when to use and how often the device should be used in an appropriate and high-quality manner.

There is no magical age when children are suddenly able to watch streaming videos, talk with their friends on Zoom, or use a computer; this will be dictated by their parents, teachers, and friends. Setting up the values at each stage will be a continuous activity the whole family can participate in. There may be struggles with family members along the way, but that is a learning experience as well and can be handled with care, consistency and empathy. Parents can learn from the children what the new technologies are and what they do and how the children's friends use them. Then, if possible, they should check them out for their children. Give the children freedom to talk about what is going on in their world, and, in response, the children may freely talk about their technology activities. Always be mindful that your children need to keep up with learning such as reading, writing, and arithmetic and not just playing games on the computer. In other words, their cognition and real-life play need time to develop for healthy growth, as discussed by Piaget. The

cognitive and psychosocial skills of children can be fostered by age-specific technologies by the parents and later in life by the children's friends and teachers who may have input to introduce certain age-specific technologies.

Children can use a computer at a young age because it may give them time to learn and grow with the technology and ask questions with their parents by their side who can encourage them to think positively and with confidence. This includes letting your infants or children who are young learn through pushing and pulling, sucking, trial and error, or egocentric behaviors to play with your phones. Keep your smartphones clean because children do put them in their mouths. As these actions are happening, it is an ideal time to talk with your children about the phone and its uses as they play with it. As children grow up, it is important to answer questions in a positive, honest, and clear manner. They will want to know what is this thing, why is it important, and how is it used.

Keep the Conversation Going with Your Children

Tom's Hardware was founded in 1996 by Tomas Pabst and is now owned by Future Plc. Future is listed on the London Stock Exchange and was founded in 1985 as a British media company. Tom's Hardware is an online high-technology and computer hardware publication. The website has reviews, news, and videos. Discussed here are its breakdown of age groups and relevant technological skills children can acquire at the various stages. We go into when and how to introduce the computer and other technological advances and review at each stage how to add new technologies relevant to your children. The following sections will review Tom's Hardware's stages for introducing children to technologies along with Piaget's cognitive stages and Erikson's psychosocial stage and the virtues associated with each stage.

Infants: Ages 0–2

At this stage infants do not have the physical or cognitive ability to understand computers. Infants do seem to look at videos of familiar faces chatting. As infants get a bit older, they may also start to press keys and mimic what they see parents and siblings doing.

The Mayo Clinic encourages during this time unstructured playtime instead of electronic media, which they believe is valuable for young children's developing brains. This is because children aged 2 and younger are learning when they interact and play with parents, siblings, and other children and adults.

The APA reiterates the American Academy of Pediatrics' digital guidelines for promoting technology use for children. These are some of their suggestions:

- For children under 18 months, avoid screen-based media except video chatting.

- For children 18 months to 24 months, parents should choose high-quality programming and watch with their children.

Perhaps this is because with video chatting children can see and learn from the responses of the person they are talking to. Shows that are programmed do not display responses or interact with the child, and this could lead to a distorted understanding of situations. According to Piaget, at the sensorimotor developmental stage, infants are figuring out object permanence and who is who depending on where they are located. It is important to work with the infant to let them know who is in the video and when they see the person in real life to know that it is the same person. The infant at this time is curious about the world and uses their motor skills of pushing and pulling and puts objects in their mouth to learn. At this stage, children imitate what parents are doing and learn this way as well.

In addition, in line with Erickson's developmental theory, infants need to understand that what they are touching is fine and that they should not be afraid of that hardware. The virtue that should be remembered is how to give hope to the infant so that it will lead children to have trust in themselves and their parents.

Toddlers: Ages 2–3

At this stage toddlers begin to show curiosity. The toddler will start "button pushing" on the computer and smartphone they move into this stage.

Tom's Hardware suggests at this age toddlers should co-use technology with adults. This means that adults need to help and guide the toddlers by navigating their hands to the right places on the keyboard and/or mouse.

Toddlers should be given minimal computer time, and this time should be limited to minutes each day. Toddlers at this age may be able to start recognizing letters and numbers on a keyboard, and each letter and number should be pointed out to toddlers as they look at the keyboard. As the toddler moves from preschool to elementary, they can start to use the mouse; it is important to use imitation so that the toddler learns the proper way to use it.

Tom's Hardware suggests that games for toddlers can be simple and cause-and-effect games like pressing a button, which causes another event to occur. The parent needs to show the toddler how to be gentle so that they do not bang, hit, drop, or throw the keyboard, mouse, or monitor around or at

anyone. The toddler at this age does not necessarily need their own computer. Show the child how to share on your PC.

Even the Mayo Clinic encourages by age 2 that children may benefit from some types of screen time, such as programming with music, movement, and stories. By the toddler watching the media with you, you have an opportunity to explain and talk with children so that they see quality screen time and how to use these skills they learn in real-life experiences. Passive screen time where the parent leaves children to watch the video should be replaced with letting children have downtime and allowing them to read a book, play with friends or by themselves, or problem-solve with toys.

The APA reiterates the American Academy of Pediatrics' digital guidelines technology use for children 2 to 5: limit their screen time to 1 hour per day with high-quality programming.

Erikson stated that the virtue at this stage is will, and allowing it to develop in toddlers will give them a sense of control—control over touching and physically controlling these devices and their environment—that will be a success for these children.

Preschool: Ages 3–4

At this time, according to Tom's Hardware, preschoolers start to play with software and often show a willingness to play games and other creative and more complex activities such as puzzles, drawing, and matching.

The preschoolers may still co-use the computer, mouse, and keyboard with an adult and even take control of these devices. Preschool children need time to play a few games or activities a day. At this age children may look for certain keys and are capable of moving a basic mouse. During this age children can use a word processor for learning letters and spelling names, and they may use computers even in school for a few tasks. Continue to reinforce that children use clean hands and gently push on buttons.

Good hygiene needs to be taught to children as well. Teach them not to eat by the computer and to wash their hands before they use it.

Erikson used the virtue of purpose during this time because the preschooler is exploring and trying to control the environment. At this stage, the parent needs to balance when and how the preschooler touches the devices. The parent needs to let children know through firm and gentle physical movements when the device is to be used or not to be used. Try to be as consistent with your instruction as much as possible.

Elementary: Ages 5–7

At this stage, elementary children can use computers independently and can play even more complex and time-based games and activities independently and with friends. Elementary children are even able to start coding with simple tools. Parents or teachers should be present, and they need to retain control of the mouse and keyboard. Children at this age can be by the computer for longer in order to work on their schoolwork and age-appropriate activities. Children at this age learn how to use a mouse with basic comfort and are likely to be using a computer regularly in school as part of their learning process. Encourage children to learn how to type. Start to talk with your children about Internet safety and family technology rules. Help your child build confidence. Help children to find games and activities that they find fun and that are developmentally appropriate for them for their own skill level. Otherwise, it may become frustrating for children. The APA reiterates the American Academy of Pediatrics' digital guidelines for promoting technology use for children 6 and up, which is to establish consistent limits on the time spent using media and the types of media.

The virtue that Erikson's theory talked about for elementary and tweens is competence. This is when the children interact more with school and friends. Be cognizant about this and encourage this behavior. Give your children time to interact with their peers and possibly play with the technology with them and explain to them what it is used for and how it should be used both with and without their friends around. Do this so that you get a feeling for what the community around you feels about the devices and how your child feels about the devices.

Tweens: Ages 8–12

Tweens at this age start to want more independence and privacy and may be rebellious, but they need guidance to help them understand what is the best course of action, particularly with online activity and social interactions. As parents start to buy their children personal devices, it is even more important to encourage clear and understandable rules and expectations of why those rules are needed. The parent should be able to open communication with the tween about family Internet safety expectations. The parent can filter or use some Internet management software as children start to explore the Internet.

At this point, tweens can work independently, but an adult should not be far away so that when children have a question, they can ask. If your children did not learn how to type at school, teach them to type properly. Also show them how to open, save, and print files. By this age children will use the computer in many different ways, including for standardized testing and everyday school activities. They may play games on the computer that involve skill.

When buying a computer, make sure it is durable, that children are able to travel with it, that the computer can handle their daily needs, and that children can play games and edit videos for their enjoyment.

Piaget's developmental theory of concrete operational thoughts, which is between the ages of 7 to 11, describes when a tween starts to think concretely or they start to use logical operations in their reasoning. It is a prime time to discuss with your child what is proper behavior as they start to work independently. Be patient and consistent when creating and establishing the rules. You could establish the rules with and without them at this point, but it is good to include them in the conversation so that they understand what and why you are establishing those rules.

Teens: Ages 13–18

At this stage, teens are able at this age to create artwork or use the computer to do assignments. Parental support can help encourage teens to be competent in these areas. Parents still need to make sure teens do not run into risky situations on the Internet.

Teach children to use the computer for high-quality searches, communication, and use. Continue to communicate with your children about their activities, and make sure that their computer can do the type of work and challenges that the teen has an interest in doing and includes the essentials they need to use at school.

At this developmental age, according to Piaget, teens and older individuals are developing abstract thinking. They are developing a moral compass and a strategy to deal with life. Encourage and talk with your children to learn in a meaningful way with others in their age group and older.

Erikson's developmental stage virtue for the ages 12 to 18 is fidelity. It is an important time for your children to realize that personal relationships matter and that they may talk with others in a meaningful and impactful way. Spend the time and effort to discuss with your children what they think they want to do in life and what they enjoy doing while encouraging them the importance of having friends and friendship values in which they could grow into.

Although age-appropriate expected skills go up to age 18 for some of the milestone's developmental stages, adults, the role models, also need some guidance. The APA gives guidance for how adults should deal with some potentially stressful situations with children.

This section talked about what values and virtues parents and caregivers can instill in their children to use technology in a useful, productive, and positive manner and at what ages different virtues and ethics should be discussed, from infant to young adult, so that they can understand them at the appropriate age.

Summary

Even for the very young who cannot even hold on a conversation it is important to explain in simple movements and words the various technologies. Use age-appropriate terms and basic concepts about the computer and devices as they develop. Begin an ongoing conversation about how teachers use technology, how friends use it at school, and even how you use it. Ask questions about what your child enjoys about technology. If there is a game or video that your children like, ask them to explain why they like it. In some cases, it might be a signal that your child is interested in actually doing a similar activity or even something more creative. Also think and talk with your children about the effects technology has on us. All this will not only help you understand what your children like to do but also make you more aware of the benefits and risks of the media children are using.

Common Problems in Today's Society

Too much screen time and regular exposure to poor-quality programming may be linked to biological problems, physical difficulties, and behavior issues, according to the Mayo Clinic. These issues may also result from too much texting and social media use. Some types of challenges are obesity, depression, violence, anxiety disorder, attention problems, and less time learning. If you see your children with any of these problems, you may want to consult a specialist, such as a family practitioner, psychiatrist, psychologist, or nutritionist. This chapter will review these issues.

Obesity

Obesity is a disorder that involves having excessive body fat, which may increase the risk of developing other health problems. Obesity often results from taking in more calories than are burned by exercise and normal daily activities. The treatment for obesity is usually exercise and eating the right foods in moderation. Dr. Thomas Robinson of Stanford University states that "Obesity is one of the most obvious adverse conditions of screen time." When children are in front of a screen, they often reach for high-caloric, low-nutrient food, and artificial beverages. Some ads influence children's and adolescent's preferences, purchase requests, consumption habits, and sleep duration.

Inadequate sleep schedules and insufficient sleep deprivation can cause "changes in the appetite-regulating hormones ghrelin and leptin to increase hunger and decrease satiety," according to Thomas Robinson, a pediatrics physician. "Short sleep duration can affect children's choices to consume more calories and fewer nutritionally-dense foods, and shorter sleep duration may lead to increased snacking and eating outside of normal mealtimes, including during the night."

Depression

Depression, according to the American Psychiatry Association (APA), is a common mental disorder and can affect anyone. Those with depression may experience some of these symptoms: lack of interest or pleasure in daily activities, lack of energy, inability to concentrate, significant weight gain or loss, and excessive sleeping or insomnia. Those with clinical depression may even feel suicidal.

The APA states that clinical depression is different from periods of sadness or bereavement. Clinical depression may be caused by various situations such as a death of a loved one, loss of a job, or the ending of a relationship (although in these situations it is normal to feel some sort of sadness or grief). Both grief and depression may involve sadness and withdrawal from typical activities.

In grief, painful feelings are often interspersed with positive memories of the deceased. In clinical depression, mood and loss of interest occur for at least two weeks. While experiencing depression, feelings of worthlessness are common, and these feelings are not apparent in grieving situations.

The ability to differentiate between grief and depression is imperative because it can help individuals get the right help and support and the proper treatment.

Depression can be manifested biologically, genetically, and environmentally. The biochemistry component is that certain biochemicals in the brain may provide symptoms of depression. The genetic component of depression may

occur in familial genes. The personality component is that those who have low self-esteem or are easily overwhelmed by stress may be more likely to experience depression. There are also environmental factors that contribute to depression, and those components may be continuous exposure to violence, neglect, abuse, or poverty. Fortunately, depression is for the most part treatable. A combination of therapy and antidepressant medication can help, for the most part, to ensure recovery.

Violence

The American Academy of Children and Adolescent Psychiatry states that watching and listening to too much violence may lead individuals to imitate that behavior in their own lives. Even toddlers and children who imitate behaviors around them can see as commonplace the violence on TV, movies, videos, and music and may imitate those violent movements of fighting, victimization, and bullying if they become desensitized by the violence.

Anxiety Disorder

Anxiety is described by feelings of tension, worried thoughts, and physiological changes such as a racing heartbeat and sweating. Anxiety disorders symptoms are recurring and intrusive thoughts.

Anxiety in normal situations is a reaction to stress and danger and can be beneficial in helping to prepare for an unwelcome or uncomfortable situation.

Anxiety disorder differs in that it involves excessive fear or anxiety to certain scenarios. Anxiety disorder is for the most part treatable, and treatment helps many continue with normal lives.

Attention Problems

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common mental disorders affecting children. ADHD is a behavioral syndrome that is characterized by the persistent symptoms involving inattention and hyperactivity. Those with this disorder may have difficulty in completing tasks or paying attention, lack of concentration, and distractibility. Children may be impatient, restless, and have trouble organizing work or taking turns. In addition, they may need to talk excessively, run around, and fidget. These symptoms could occur before the age of 7 in different situations and impair social, academic, or occupational functioning.

Less Time Learning

With all these gadgets, the smartphone and computer games, kids are preoccupied and are spending less time learning. Even in the classroom and during playtime with their peers kids are turning to their devices. Encourage unstructured playtime with no devices and discourage use of extra technology during homework. Encourage real-life friendships. Some kids may find connecting with peers difficult and may spend more time online than playing with real-life friends. Digital friendships are not a substitute or replacement for real-life interactions. Talk and enable good communication with children so that they develop strong social skills so that they feel confident to have real-life relationships.

You may want or need to set daily or weekly screen time limits on devices. When you allow your children to watch smart TV or any of their smart electronic applications, the quality of the screen time matters. Preview programs, games, and apps before allowing children to view or play with them. Seek out interactive and educational games and apps that engage your child, rather than just require the child to push and swipe. It is helpful if parents or guardians are close by during screen time so that they can supervise their activities. Ask and talk with your child on a regular basis about the programs, games, and apps they use. Encourage frequent breaks to stretch, get physical activity, and avoid eyestrain. Do not bang on, drop, hit the computer, keyboard, or monitor. Show kids proper etiquette to use and keep the hardware clean.

Set up computers in a way that is ergonomically friendly for the age/size of your kids. They may need a booster seat to use a mouse, monitor, etc., at appropriate angles. Enable Internet filters that allow you to block/manage your kids' access to online content. Young kids may only need access to a few games and favorite websites, while older kids may need broader access for school projects and creative activities.

Use the time when watching programming with your child to discuss what you are watching and to educate your children about what they are seeing. Encourage digital literacy. When children are exposed to "bad" content on devices without Internet filters, talk to your child about the situations and how you expect them to behave.

When children are young, try to avoid fast-paced programming so that children can understand what they are watching. Also, try to avoid violent content and apps with a lot of distracting content. Teach your children what is factual content and what is not. Establish clear values and virtues to explain rules and set reasonable limits for your child's use of digital media.

Encourage your child to think critically about what they see on their screens and teach appropriate and ethical behaviors. Enable children to understand that all media consist of points of view. Explain that many types of technology

collect data to send users ads or to make money and how and why to avoid and ignore them.

Online relationships and social media have become a major part of adolescent and adult life in general. Explain when needed what sexting, cyberbullying, and sharing personal information online is, explain that they are not acceptable behavior, and explain how they should be avoided and not tolerated. Let your children know that they can talk to you about situations that make them feel uncomfortable. Let children know not to send or share anything online that they would not want the entire world to see and remember forever. That includes personal information such as name, address, and other identifying information.

Important Tips and Suggestions

No matter what age your kids are, you need to keep your circle of unity safe and sound. The following are suggestions to keep in mind. Some of these are tips from Tom Harding as described in the previous chapter that are elaborated upon.

Don't overreact if you see your child playing around with technology. It is an important part of our modern world. It will not help your child to grow and develop securely if you set overly restrictive limits or send the message that technology is something to fear even if you, as an adult, do not understand the technology. If you do not understand the technology, focus on teaching healthy habits that will stay with your child for a lifetime.

Consider the context when establishing your family's rules for technology use and know why you are setting these rules up. For instance, using Zoom or FaceTime to talk with grandparents is different from playing a video game, especially a violent video game. Children should respect the former and understand the warning and consequences of the latter. If needed at times, allow your child to be entertained with a little extra screen time that day, but just do this once in a while.

At bedtime it may be necessary to restrict digital use because it may interfere with your children's quality of sleep.

Look and quietly observe what children are doing online and make sure it is honest and in good practice. When they are young adults, it is not easy knowing what they are doing. At that point it is important to have open and honest discussions about what sites and types of content are off-limits. Before you talk with them, do some research to understand the social media and technology your children know. If it is possible, look at their history browser.

Teach good online behavior and talk with children about respect and courtesy online and during in-person interactions. It is more commonplace these days

to say things online that never would be said if the person was in front of you. Encourage children to go to the parent or caretaker if they witness cyberbullying or troubling online activity. Talk to your children about what is bothering them.

Discuss decision-making and talk with children about how to evaluate digital authenticity and accuracy online. Explain to them not to download unfamiliar programs, click suspicious links, or share personal information on unknown apps or websites because it may be hazardous to them and the family at large. Also teach children not to respond to unsolicited messages from strangers online or in real life.

Summary

Encourage real-life friendships, social activities, and game playing. It is not easy to connect with peers in person as some children are spending more time online in a virtual reality world. Children learn appropriate behaviors through trial and error in real-life situations. The goal is to help children build awareness and learn, ultimately, to regulate their relationship with devices.

In sum, talk to children and teach them about technology and its uses from a young age. These conversations should be ongoing and should become more detailed as your children develop and are able to connect with technology and with others. Use your judgment and state your values at each stage of development. Do not assume technology use is inherently harmful, and encourage conversations about the uses and practices of technology.

Conclusion

Living on this earth these days is busy, entertaining, and interesting, and it is easier now to see and experience people and places even if you are not physically at or with them. With technology, we are able to see, hear, and almost touch others through social media, texting, and videos.

This will become even more advanced as machine learning capabilities improve. New and interesting places in the world can be observed and almost touched virtually with special glasses, gloves, and gadgets. Imagine the places you could go and the people you could meet. This is really incredible and remarkable!

Yet, there are consequences that are real and that need to be addressed. Parents, teachers, mentors, and caretakers need to consider how to address the virtues that their family would like to live by. This involves critical thinking that is constantly evolving to figure out how to present the real world to your children and how to show empathy to everyone you encounter, one person at a time. It takes time and consideration to understand and empathize with what others are saying.

The big picture is that without our real-life circle of parents, family, teachers, mentors, and friends—our circle of unity—we are alone. We can wear smart glasses all day and talk endlessly to strangers, but when you take them off, you are alone. This book is a framework to start a conversation in families about how to approach these new advances in technology. We should never lose sight that our parents, families, teachers, mentors, and friends are our people, and we can physically see, hear, and touch them. Piaget and Erikson both intimate that we learn about the world and ourselves by interacting with parents, teachers, and friends whether it is by playing games or in other ways. They are our core, our circle of unity, of what our world should be about.

B

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