Organized Mind

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Introduction

- ❏ Some neuroscientists believe that nearly every conscious experience is stored somewhere in your brain; the hard part is finding it and pulling it out again. Sometimes the information that comes out is incomplete, distorted, or misleading.
- ❏ Cognitive psychologists have provided mountains of evidence over the last twenty years that memory is unreliable. And to make matters worse, we show staggering overconfidence in many recollections that are false. It's not just that we remember things wrongly (which would be bad enough), but we don't even know we're remembering them wrongly, doggedly insisting that the inaccuracies are in fact true.
- ❏ Suppose the writing contains information about edible plants. Maybe it was written at the morbid scene of watching a favorite uncle die from eating a poisonous berry—wanting to preserve information about what that plant looks like and how to distinguish it from a nutritious plant that is similar in appearance. The indexing problem is that there are several possibilities about where you store this report, based on your needs: It could be stored with other writings about plants, or with writings about family history, or with writings about cooking, or with writings about how to poison an enemy. Here we come upon two of the most compelling properties of the human brain and its design: richness and associative access. Richness refers to the theory that a large number of the things you've ever thought or experienced are still in there, somewhere. Associative access means that your thoughts can be accessed in a number of different ways by semantic or perceptual associations—memories can be triggered by related words, by category names, by a smell, an old song or photograph, or even seemingly random neural firings that bring them up to consciousness.

- ❏ Most mammals are biologically programmed to put their digestive waste away from where they eat and sleep. Dogs have been known to collect their toys and put them in baskets; ants carry off dead members of the colony to burial grounds; certain birds and rodents create symmetrically organized barriers around their nests in order to more easily detect intruders.
- ❏ The need for taking charge of our attentional and memory systems has never been greater. Our brains are busier than ever before. We're assaulted with facts, pseudo facts, jibber-jabber, and rumor, all posing as information.
- ❏ From the many thousands of ways that individuals differ from one another, a mathematical model can be constructed that accounts for a great deal of variation, organizing human differences into five categories: extroversion agreeableness neuroticism openness to new experience conscientiousness

The Inside History of Cognitive Overload

- ❏ Most of us have adopted a strategy to get along called satisficing, a term coined by the Nobel Prize winner Herbert Simon, one of the founders of the fields of organization theory and information processing. Simon wanted a word to describe not getting the very best option but one that was good enough. For things that don't matter critically, we make a choice that satisfies us and is deemed sufficient. You don't really know if your dry cleaner is the best—you only know that they're good enough. And that's what helps you get by. You don't have time to sample all the dry cleaners within a twenty-four-block radius of your home. Does Dean & DeLuca really have the best gourmet takeout? It doesn't matter—it's good enough.
- ❏ Satisficing is one of the foundations of productive human behavior; it prevails when we don't waste time on decisions that don't matter, or more accurately, when we don't waste time trying to find improvements that are not going to make a significant difference in our happiness or satisfaction.
- ❏ Recent research in social psychology has shown that happy people are not people who have more; rather, they are people who are happy with what they already have.
- ❏ Satisficing is a tool for not wasting time on things that are not your highest priority. For your high-priority endeavors, the old-fashioned pursuit of excellence remains the right strategy.
- ❏ Neuroscientists have discovered that unproductivity and loss of drive can result from decision overload.
- ❏ It's as though our brains are configured to make a certain number of decisions per day and once we reach that limit, we can't make any more, regardless of how important they are. One of the most useful findings in recent neuroscience could be summed up as: The decision-making network in our brain doesn't prioritize.
- ❏ Our brains do have the ability to process the information we take in, but at a cost: We can have trouble separating the trivial from the important, and all this information processing makes us tired.

- ❏ The processing capacity of the conscious mind has been estimated at 120 bits per second. That bandwidth, or window, is the speed limit for the traffic of information we can pay conscious attention to at any one time.
- ❏ Two of the most crucial principles used by the attentional filter are change and importance.
- ❏ A critical point that bears repeating is that attention is a limited-capacity resource—there are definite limits to the number of things we can attend to at once.
- ❏ The human brain has evolved to hide from us those things we are not paying attention to.
- ❏ Lacking the opportunity to hear information directly from a speaker's mouth, the antiwriting contingent complained that it would be impossible to verify the accuracy of the writer's claims, or to ask follow-up questions. Even Plato voiced these fears; his King Thamus decried that the dependence on written words would "weaken men's characters and create forgetfulness in their souls."
- ❏ This externalization of facts and stories meant people would no longer need to mentally retain large quantities of information themselves and would come to rely on stories and facts as conveyed, in written form, by others. Thamus, king of Egypt, argued that the written word would infect the Egyptian people with fake knowledge.
- ❏ Brevity is often thought of as a virtue, but then again, the whole point of a book is that you don't have to be brief.
- ❏ The Roman philosopher Seneca the Younger (tutor to Nero) complained that his peers were wasting time and money accumulating too many books. Instead, Seneca recommended focusing on a limited number of good books, to be read thoroughly and repeatedly. Too much information could be harmful to your mental health.
- ❏ Leibniz complained about "that horrible mass of books that keeps on growing" and that would ultimately end in nothing less than a "return to barbarism."
- ❏ A steady flow of complaints about the proliferation of books reverberated into the late 1600s. Intellectuals warned that people would stop talking to each other, burying themselves in books, polluting their minds with useless, fatuous ideas.
- ❏ A third principle of attention—not specific to the attentional filter—is relevant now more than ever. It has to do with the difficulty of attentional switching. Switching attention comes with a high cost.
- ❏ The attentional filter evolved to help us to stay on task, letting through only information that was important enough to deserve disrupting our train of thought.
- ❏ Multitasking is the enemy of a focused attentional system. Increasingly, we demand that our attentional system try to focus on several things at once, something that it was not evolved to do.
- ❏ Attention is a limited-capacity resource.
- ❏ Collectively, this is known as shadow work—it represents a kind of parallel, shadow economy in which a lot of the service we expect from companies has been transferred to the customer. Each of us is doing the work of others and not getting paid for it. It is responsible for taking away a great deal of the leisure time we thought we would all have in the twenty-first century.

- ❏ We are social creatures. We are easily swayed by first-person stories and vivid accounts of a single experience. Although this is statistically wrong and we should learn to overcome the bias, most of us don't.
- ❏ Advertisers know this, and this is why we see so many first-person testimonial advertisements on TV.
- ❏ Our brains focus on vivid, social accounts more than dry, boring, statistical accounts.
- ❏ Cognitive psychology is the scientific study of how humans (and animals and, in some cases, computers) process information.
- ❏ One of the earliest distinctions made was between now and not-now; these things are happening in the moment, these other things happened in the past and are now in my memory.
- ❏ Many of the world's preindustrial languages have only two terms for color, roughly dividing the world into light and dark colors.
- ❏ When a language advances and adds a third term to its lexicon for color, the third term is always red. Various theories have been proposed, the dominant one being that red is important because it is the color of blood. When a
- ❏ Those who were interested in acquiring knowledge—whose brains enjoyed learning new things—would have been at an advantage for survival, and so this love of learning would eventually become encoded in their genes through natural selection.
- ❏ Some birds and rodents create boundaries around their nests, typically out of rocks or leaves, that are ordered; if the order is disturbed, they know that an intruder has come by.
- ❏ Some learning enhances our lives, some is irrelevant and simply distracts us—tabloid stories probably fall into this latter category (unless your profession is as a tabloid writer). Successful people are expert at categorizing useful versus distracting knowledge.
- ❏ Active sorting is a powerful way to prevent yourself from being distracted. It creates and fosters great efficiencies, not just practical efficiencies but intellectual ones. After you have prioritized and you start working, knowing that what you are doing is the most important thing for you to be doing at that moment is surprisingly powerful. Other things can wait—this is what you can focus on without worrying that you're forgetting something.
- ❏ There is a deep and simple reason why active sorting facilitates this. The most fundamental principle of the organized mind, the one most critical to keeping us from forgetting or losing things, is to shift the burden of organizing from our brains to the external world. If we can remove some or all of the process from our brains and put it out into the physical world, we are less likely to make mistakes.

How Attention and Memory Work

- ❏ This distinctive and special brain state is marked by the flow of connections among disparate ideas and thoughts, and a relative lack of barriers between senses and concepts. It also can lead to great creativity and solutions to problems that seemed unsolvable.

- ❏ The tendency for this system to take over is so powerful that its discoverer, Marcus Raichle, named it the default mode. This mode is a resting brain state, when your brain is not engaged in a purposeful task, when you're sitting on a sandy beach or relaxing in your easy chair with a single malt Scotch, and your mind wanders fluidly from topic to topic. It's not just that you can't hold on to any one thought from the rolling stream, it's that no single thought is demanding a response.
- ❏ We pay attention to one thing, either through conscious decision or because our attentional filter deemed it important enough to push it to the forefront of attentional focus. When we pay attention to one thing, we are necessarily taking attention away from something else.
- ❏ In the mind-wandering mode, our thoughts are mostly directed inward to our goals, desires, feelings, plans, and also our relationship with other people—the mind-wandering mode is active when people are feeling empathy toward one another.
- ❏ Neuroscientists are increasingly appreciating that consciousness is not an all-or-nothing state; rather, it is a continuum of different states.
- ❏ Consciousness itself is not a thing, and it is not localizable in the brain. Rather, it's simply the name we put to ideas and perceptions that enter the awareness of our central executive, a system of very limited capacity that can generally attend to a maximum of four or five things at a time.
- ❏ There are four components in the human attentional system: the mind-wandering mode, the central executive mode, the attentional filter, and the attentional switch, which directs neural and metabolic resources among the mind-wandering, stay-on-task, or vigilance modes.
- ❏ The serotonin transporter gene SLC6A4 has been found to correlate with artistic behaviors as well as spirituality,
- ❏ nicotine creates a state of vigilance that allows one to become more detail oriented and less dependent on top-down expectations.
- ❏ Drugs, such as guanfacine (brand names Tenex and Intuniv) and clonidine, that are prescribed for hypertension, ADHD, and anxiety disorders can block noradrenaline release, and in turn block your alerting to warning signals.
- ❏ "Our walls are filled with books, our file cabinets with papers, our notebooks with jottings, our homes with artifacts and souvenirs."
- ❏ our memory tends to be poor most of the time, not because of the limited capacity of our brains to store the information but because of the nature of memory retrieval, which can easily become distracted or confounded by other, similar items.
- ❏ The two most important rules are that the best-remembered experiences are distinctive/unique or have a strong emotional component.
- ❏ if the more audacious theorists are right, everything you've experienced is "in there" somewhere, waiting to be accessed. Then why don't we become overwhelmed by memory? Why is it that when you think of hash browns, your brain doesn't automatically deliver up every single time you've ever had hash browns? It's because the brain organizes similar memories into categorical bundles.

- ❏ Cognitive economy dictates that we categorize things in such a way as not to be overwhelmed by details that, for most purposes, don't matter. Obviously, there are certain things on which you want detailed information right now, but you never want all the details all the time.
- ❏ In all these cases and many more—an entrepreneur launching a company, an aircraft pilot planning a landing—the person performing the work holds an image or ideal in mind, and attempts to get it manifested in the real world so that the appearance of the thing matches the mental image.
- ❏ The distinction between appearance and a mental image traces its roots back to Aristotle and Plato and was a cornerstone of classic Greek philosophy. Aristotle and Plato both spoke of a distinction between how something appears and how it really and truly is.
- ❏ This ability to recognize diversity and organize it into categories is a biological reality that is absolutely essential to the organized human mind.
- ❏ How are categories formed in our brains? Generally, there are three ways. First, we categorize them based on either gross or fine appearance. Gross appearance puts all pencils together in the same bin.
- ❏ A second way we categorize is based on functional equivalence when objects lack similarity of appearance.
- ❏ A third way we categorize is in conceptual categories that address particular situations. Sometimes these are done on the fly, leading to ad hoc categories. For example: What do the following items have in common? Your wallet, childhood photographs, cash, jewelry, and the family dog. They don't have any physical similarities, and they lack functional similarities. What binds them together is that they are "things you might take out of your house in case of a fire."
- ❏ Calendars, smartphones, and address books are also brain extenders, externalizing onto paper or into computer chips myriad details that we no longer have to keep in our heads. Historically, the ultimate brain extenders were books, keeping track of centuries' worth of collected knowledge that we can access when we need it.
- ❏ People at the top of their professions, in particular those known for their creativity and effectiveness, use systems of attention and memory external to their brain as much as they can. And a surprising number of them, even in high-tech jobs, use decidedly low-tech solutions for keeping on top of things.
- ❏ When we have something on our minds that is important—especially a To Do item—we're afraid we'll forget it, so our brain rehearses it, tossing it around and around in circles in something that cognitive psychologists actually refer to as the rehearsal loop, a network of brain regions that ties together the frontal cortex just behind your eyeballs and the hippocampus in the center of your brain. This rehearsal loop evolved in a world that had no pens and paper, no smartphones or other physical extensions of the human brain; it was all we had for tens of thousands of years and during that time, it became quite effective at remembering things. The problem is that it works too well, keeping items in rehearsal until we attend to them. Writing them down gives both implicit and explicit permission to the rehearsal loop to let them go, to relax its neural circuits so that we

can focus on something else. “If an obligation remained recorded only mentally,” Allen says, “some part of me constantly kept thinking that it should be attended to, creating a situation that was inherently stressful and unproductive.”

- ❏ If you want to look at this from a Zen point of view, the Masters would say that the constant nagging in your mind of undone things pulls you out of the present—tethers you to a mind-set of the future so that you’re never fully in the moment and enjoying what’s now.

Organizing Our Homes

- ❏ Women’s cortisol levels (the stress hormone) spike when confronted with such clutter (men’s, not so much). Elevated cortisol levels can lead to chronic cognitive impairment, fatigue, and suppression of the body’s immune system.
- ❏ The key to creating useful categories in our homes is to limit the number of types of things they contain to one or at most four types of things (respecting the capacity limitations of working memory).
- ❏ Multitasking has been found to increase the production of the stress hormone cortisol as well as the fight-or-flight hormone adrenaline, which can overstimulate your brain and cause mental fog or scrambled thinking. Multitasking creates a dopamine-addiction feedback loop, effectively rewarding the brain for losing focus and for constantly searching for external stimulation. To make matters worse, the prefrontal cortex has a novelty bias, meaning that its attention can be easily hijacked by something new—the proverbial shiny objects we use to entice infants, puppies, and kittens. The irony here for those of us who are trying to focus amid competing activities is clear: The very brain region we need to rely on for staying on task is easily distracted.
- ❏ Russ Poldrack, a neuroscientist at Stanford, found that learning information while multitasking causes the new information to go to the wrong part of the brain. If students study and watch TV at the same time, for example, the information from their schoolwork goes into the striatum, a region specialized for storing new procedures and skills, not facts and ideas. Without the distraction of TV, the information goes into the hippocampus, where it is organized and categorized in a variety of ways, making it easier to retrieve it. MIT’s Earl Miller adds, “People can’t do [multitasking] very well, and when they say they can, they’re deluding themselves.” And it turns out the brain is very good at this deluding business.
- ❏ Asking the brain to shift attention from one activity to another causes the prefrontal cortex and striatum to burn up oxygenated glucose, the same fuel they need to stay on task. And the kind of rapid, continual shifting we do with multitasking causes the brain to burn through fuel so quickly that we feel exhausted and disoriented after even a short time.
- ❏ Among other things, repeated task switching leads to anxiety, which raises levels of the stress hormone cortisol in the brain, which in turn can lead to aggressive and impulsive behaviors. By contrast, staying on task is controlled by the anterior cingulate and the striatum, and once we

engage the central executive mode, staying in that state uses less energy than multitasking and actually reduces the brain's need for glucose.

- ❏ To make matters worse, lots of multitasking requires decision-making: Do I answer this text message or ignore it? How do I respond to this? How do I file this e-mail? Do I continue what I'm working on now or take a break? It turns out that decision-making is also very hard on your neural resources and that little decisions appear to take up as much energy as big ones. One of the first things we lose is impulse control. This rapidly spirals into a depleted state in which, after making lots of insignificant decisions, we can end up making truly bad decisions about something important.
- ❏ For decades, efficient workers would shut their doors and turn off their phones for "productivity hours," a time when they could focus without being disturbed. Turning off our e-mail follows in that tradition and it does soothe the brain, both neurochemically and neuroelectrically.

Organizing Our Social World

- ❏ As shadow work increases and we are called upon to do more of our own personal business management, the need to have accounts with multiple companies has mushroomed.
- ❏ Because our ancestors lived in social groups that changed slowly, because they encountered the same people throughout their lives, they could keep almost every social detail they needed to know in their heads. These days, many of us increasingly find that we can't keep track of all the people we know and new people we meet. Cognitive neuroscience says we should externalize information in order to clear the mind.
- ❏ In the early days of our species, group membership was essential for protection from predators and enemy tribes, for the sharing of limited food resources, the raising of children, and care when injured. Having a social network fulfills a deep biological need and activates regions of the brain in the anterior prefrontal cortex that help us to position ourselves in relation to others, and to monitor our social standing. It also activates emotional centers in the brain's limbic system, including the amygdala, and helps us to regulate emotions. There is comfort in belonging.
- ❏ Beyond companionship, couples seek intimacy, which can be defined as allowing another person to share and have access to our private behaviors, personal thoughts, joys, hurts, and fears of being hurt. Intimacy also includes creating shared meaning—those inside jokes, that sideways glance that only your sweetie understands—a kind of telepathy. It includes the freedom to be who we are in a relationship (without the need to project a false sense of ourselves) and to allow the other person to do the same. Intimacy allows us to talk openly about things that are important to us, and to take a clear stand on emotionally charged issues without fear of being ridiculed or rejected. All this describes a distinctly Western view—other cultures don't view intimacy as a necessity or even define it in the same way.
- ❏ Of the thousands of ways that human beings differ from one another, perhaps the most important trait for getting along with others is agreeableness. In the scientific literature, to be agreeable is to

be cooperative, friendly, considerate, and helpful—attributes that are more or less stable across the lifetime, and show up early in childhood.

- ❏ Agreeable people are able to control undesirable emotions such as anger and frustration. This control happens in the frontal lobes, which govern impulse control and help us to regulate negative emotions, the same region that governs our executive attention mode.
- ❏ Matchmaking or "romantic partner assistance" is not new. The Bible describes commercial matchmakers from over two thousand years ago, and the first publications to resemble modern newspapers in the early 1700s carried personal advertisements of people (mostly men) looking for a spouse. At various times in history, when people were cut off from potential partners—early settlers of the American West, Civil War soldiers, for example—they took to advertising for partners or responding to ads placed by potential partners, providing a list of attributes or qualities.
- ❏ A large part of human social interaction requires that we subdue our innate primate hostilities in order to get along. Although primates in general are among the most social species, there are few examples of primate living groups that support more than eighteen males within the group—the interpersonal tensions and dominance hierarchies just become too much for them and they split apart. And yet humans have been living in cities containing tens of thousands of males for several millennia. How do we do it? One way of helping to keep large numbers of humans living in close proximity is through the use of nonconfrontational speech, or indirect speech acts. Indirect speech acts don't say what we actually want, but they imply it. The philosopher Paul Grice called these implicatures.
- ❏ The philosopher John Searle says the mechanism by which indirect speech acts work is that they invoke in both the speaker and the hearer a shared representation of the world; they rely on shared background information that is both linguistic and social. By appealing to their shared knowledge, the speaker and listener are creating a pact and affirming their shared worldview.
- ❏ The four Gricean maxims are: Quantity. Make your contribution to the conversation as informative as required. Do not make your contribution more informative than is required. Quality. Do not say what you believe to be false. Do not say that for which you lack adequate evidence. Manner. Avoid obscurity of expression (don't use words that your intended hearer doesn't know). Avoid ambiguity. Be brief (avoid unnecessary prolixity). Be orderly. Relation. Make your contribution relevant.
- ❏ Individuals with autism spectrum disorder often have difficulty with indirect speech acts because of biological differences in their brains that make it difficult for them to understand irony, pretense, sarcasm, or any nonliteral speech.
- ❏ There's a hormone in the brain released by the back half of the pituitary gland, oxytocin, that has been called by the popular press the love hormone, because it used to be thought that oxytocin is what causes people to fall in love with each other. When a person has an orgasm, oxytocin is released, and one of the effects of oxytocin is to make us feel bonded to others. Evolutionary psychologists have speculated that this was nature's way of causing couples to want to stay

together after sex to raise any children that might result from that sex. In other words, it is clearly an evolutionary advantage for a child to have two caring, nurturing parents. If the parents feel bonded to each other through oxytocin release, they are more likely to share in the raising of their children, thus propagating their tribe.

- ❏ Oxytocin in individuals with autism shows up at lower than normal levels, and the administration of oxytocin causes them to become more social, and improves emotion recognition….
- ❏ Oxytocin has additionally been implicated in feelings of trust. In a typical experiment, people watch politicians making speeches. The observers are under the influence of oxytocin for half the speeches they watch, and a placebo for the other half (of course they don't know which is which). When asked to rate whom they trust the most, or whom they would be most…
- ❏ There's a well-established finding that people who receive social support during illness (simple caring and nurturing) recover more fully and more quickly. This simple social contact when we're sick also releases oxytocin, in turn…
- ❏ Paradoxically, levels of oxytocin also increase during gaps in social support or poor social functioning (thus absence does make the heart…
- ❏ Its real role is to organize social behavior. Promising preliminary evidence suggests that oxytocin pharmacotherapy can help to promote trust and reduce social anxiety, including in people with social phobia and borderline personality disorder. Nondrug therapies, such as music, may exert similar therapeutic effects via oxytocinergic regulation; music has been…
- ❏ A related chemical in the brain, a protein called arginine vasopressin, has also been found to regulate affiliation, sociability, and courtship. If you think your social behaviors are largely under your conscious control, you're underestimating the role…
- ❏ Recreational drugs such as cannabis and LSD have been found to promote feelings of connection between people who take those drugs and others, and in many cases, a feeling of being more connected to the world-as-a-whole. The active ingredient in marijuana activates specialized neural receptors called cannabinoid receptors, and it has been shown experimentally in rats that they increase social activity (when the rats could get up off the couch). LSD's action in the brain includes stimulating dopamine and certain serotonin receptors while attenuating sensory input from the…
- ❏ Our own lives seem to us to be more filled with rich diversity of thoughts and behaviors because we are experiencing a wider range of behaviors in ourselves while effectively having only one-sided evidence about others. Harvard psychologist Daniel Gilbert calls this the "invisibility" problem—the inner thoughts of others are invisible to us.
- ❏ Like visual illusions, cognitive illusions are automatic—that is, even when we know they exist, it is difficult or impossible to turn off the mental machinery that gives rise to them.
- ❏ Cognitive illusions lead us to misperceive reality and to make poor decisions about choices we are presented with, medical options, and interpreting the behaviors of other people, particularly those who comprise our social world.

- ❏ Misinterpreting the motivations of others leads to misunderstandings, suspicion, and interpersonal conflict and, in the worst cases, war. Fortunately, many cognitive illusions can be overcome with training.
- ❏ One of the most well established findings in social psychology concerns how we interpret the actions of others, and it's related to the demonstration above. There are two broad classes of explanation for why people do what they do—dispositional or situational. Dispositional explanations embrace the idea that all of us have certain traits (dispositions) that are more or less stable across our lifetimes. As you just saw, we have a tendency to describe the people we know in trait terms: They're extroverts or introverts, agreeable or disagreeable, the life of the party or a stick-in-the-mud. Situational explanations, on the other hand, acknowledge that momentary circumstances sometimes contribute to our responses and can override any innate predispositions. These oppositional approaches are sometimes characterized as "the person versus the situation." Dispositional explanations say, "I was born (or made) that way." Situational ones (to quote comedian Flip Wilson) say, "The devil made me do it."
- ❏ There have been dozens of demonstrations of people making incorrect predictions, overweighting the influence of traits and undervaluing the power of the situation when attempting to explain people's behavior. This cognitive illusion is so powerful it has a name: the fundamental attribution error. An additional part of the fundamental attribution error is that we fail to appreciate that the roles people are forced to play in certain situations constrain their behavior.
- ❏ Another cognitive illusion that concerns social judgments is that we tend to have a very difficult time ignoring information that has been shown later to be false.
- ❏ We don't have to like what our parents like or say we should like—we explore and subsequently develop and refine our own tastes in music, clothing, films, books, and activities.
- ❏ We tend—erroneously of course—to think of people who are members of our group, whatever that group may be, as individuals, while we think of members of out-groups as a less well differentiated collective. That is, when asked to judge how disparate are the interests, personalities, and proclivities of the people in our group (the in-group) versus another group (the out-group), we tend to overestimate the similarities of out-group members.
- ❏ When we think about organizing our social world, the implication of in-group/out-group bias is clear. We have a stubborn tendency to misjudge outsiders and hence diminish our abilities to forge new, cooperative, and potentially valuable social relations.
- ❏ Racism is a form of negative social judgment that arises from a combination of belief perseverance, out-group bias, categorization error, and faulty inductive reasoning. We hear about a particular undesirable trait or act on the part of an individual, and jump to the false conclusion that this is something completely predictable for someone of that ethnic or national background.
- ❏ Once we have a stereotype, we tend not to reevaluate the stereotype; we instead discard any new, disconfirming evidence as "exceptions." This is a form of belief perseveration.
- ❏ This tendency to not get involved is driven by three powerful, interrelated psychological principles. One is the strong desire to conform to others' behavior in the hope that it will allow us to gain

acceptance within our social group, to be seen as cooperative and agreeable. The second is social comparison—we tend to examine our behavior in terms of others.

- ❏ The third force pushing us toward inaction is diffusion of responsibility. This is based on very natural and ingrained feelings about equity and wanting to punish freeloaders: "Why should I stick my neck out if all these other people aren't—they could do something about it just as well as I could."
- ❏ Humans and other animals are often unselfish. Geese will come to the aid of one another at great personal risk; vervet monkeys broadcast alarm calls when predators are near, greatly increasing their own visibility to those predators, and meerkats stand guard for predators while the rest of their pack are eating. What is the neurochemical mechanism that supports this altruistic sentinel behavior? Oxytocin—the same social-affiliative hormone that increases trust and social cooperation among humans. The distinction between our selfish and altruistic responses can be seen as a categorization error.
- ❏ When we are engaging in conformity, social comparison, or diffusion of responsibility, we are categorizing ourselves with the larger group as opposed to the victim.
- ❏ We see ourselves as standing with them, and they become our in-group. We fail to identify with the victim, who becomes a mistrusted, or at the very least misunderstood, member of an out-group.

Organizing Our Time

- ❏ Damage to the prefrontal cortex wreaks havoc with the ability to plan a sequence of events and thereby sustain calm, productive effort resulting in the accomplishment of the goals we've set ourselves in the time we have.
- ❏ Both mystics and physicists tell us that time is an illusion, simply a creation of our minds. In this respect, time is like color—there is no color in the physical world, just light of different wavelengths reflecting off of objects; as Newton said, the light waves themselves are colorless.
- ❏ Our entire sense of color results from the visual cortex in our brains processing these wavelengths and interpreting them as color.
- ❏ The three most familiar divisions of time we make today continue to be based on the motions of heavenly bodies, though now we call this astrophysics. The length of a year is determined by the time it takes the earth to circle the sun; the length of a month is (more or less) the time it takes the moon to circle the earth; the length of a day is the time it takes the earth to rotate on its axis (and observed by us as the span between two successive sunrises or sunsets). But further divisions are not based on any physical laws and tend to be based on historical factors that are largely arbitrary. There is nothing inherent in any biological or astrophysical cycle that would lead to the division of a day into twenty-four equal segments.
- ❏ The current practice of dividing the clock into twenty-four comes from the ancient Egyptians, who divided the day into ten parts and then added an hour for each of the ambiguous periods of

twilight, yielding twelve parts. Egyptian sundials in archeological sites testify to this. After nightfall, time was kept by a number of means, including tracking the motion of the stars, the burning of candles, or the amount of water that flowed through a small hole from one vessel to another. The Babylonians also used fixed duration with twenty-four hours in a day, as did Hipparchus, the ancient Greek mathematician and astronomer.

- ❏ A few species don't age at all and so are technically immortal. These include some species of jellyfish, flatworms (planaria), and hydra; the only causes of death in them are from injury or disease. This is in stark contrast to humans—of the roughly 150,000 people who die in the world each day, two-thirds die from age-related causes, and this number can reach 90% in peaceful industrialized nations, where war or disease is less likely to shorten life.
- ❏ If a sound has a gap in it shorter than 10 milliseconds, we will tend not to hear it, because of resolution limits of the auditory system.
- ❏ If you're flipping through static (still) pictures, they must be presented slower than about once every 40 milliseconds in order for you to see them as separate images.
- ❏ We have a more highly developed prefrontal cortex than any other species. It's the seat of many behaviors that we consider distinctly human: logic, analysis, problem solving, exercising good judgment, planning for the future, and decision-making.
- ❏ Like real CEOs, these cerebral CEOs are highly paid in metabolic currency. Understanding how they work (and exactly how they get paid) can help us to use their time more effectively.
- ❏ Because the prefrontal cortex doesn't fully develop in humans until after age twenty, impulse control isn't fully developed in adolescents (as many parents of teenagers have observed). It's also why children and adolescents are not especially good at planning or delaying gratification.
- ❏ If your inhibitions are reduced, and you're impaired at seeing the future consequences of your actions, you tend to do things now that you might regret later, or that make it difficult to properly complete projects you're working on.
- ❏ Binge-watch an entire season of Mad Men instead of working on the Pensky file? Eat a donut (or two) instead of sticking to your diet? That's your prefrontal cortex not doing its job. In addition, damage to the prefrontal cortex causes an inability to effectively go forward or backward in time in one's mind—remember Peter the architect's description of starting over and over and not being able to move forward.
- ❏ As if that weren't enough, advanced prefrontal cortex damage interferes with the ability to make connections and associations between disparate thoughts and concepts, resulting in a loss of creativity. The prefrontal cortex is especially important for generating creative acts in art and music. This is the region of the brain that is most active when creative artists are functioning at their peak.
- ❏ If you're interested in seeing what it's like to have prefrontal cortex damage, there's a simple, reversible way: Get drunk. Alcohol interferes with the ability of prefrontal cortex neurons to communicate with one another, by disrupting dopamine receptors and blocking a particular kind of neuron called an NMDA receptor, mimicking the damage we see in frontal lobe patients. Heavy

drinkers also experience the frontal lobe system double whammy: They may lose certain capabilities, such as impulse control or motor coordination or the ability to drive safely, but they aren't aware that they've lost them—or simply don't care—so they forge ahead anyway.

- ❏ An overgrowth of dopaminergic neurons in the frontal lobes leads to autism (characterized by social awkwardness and repetitive behaviors), which mimics frontal lobe damage to some degree.
- ❏ The opposite, a reduction of dopaminergic neurons in the frontal lobes, occurs in Parkinson's disease and attention deficit disorder (ADD).
- ❏ From autism and Parkinson's, we've learned that too much or too little dopamine causes dysfunction.
- ❏ The entire brain weighs three pounds (1.4 kg) and so is only a small percentage of an adult's total body weight, typically 2%. But it consumes 20% of all the energy the body uses.
- ❏ the brain burns glucose, as a car burns gasoline, to fuel mental operations. Just how much energy does the brain use? In an hour of relaxing or daydreaming, it uses eleven calories or fifteen watts—about the same as one of those new energy-efficient lightbulbs. Using the central executive for reading for an hour takes about forty-two calories. Sitting in class, by comparison, takes sixty-five calories—not from fidgeting in your seat (that's not factored in) but from the additional mental energy of absorbing new information. Most brain energy is used in synaptic transmission, that is, in connecting neurons to one another and, in turn, connecting thoughts and ideas to one another.
- ❏ What all this points to is that good time management should mean organizing our time in a way that maximizes brain efficiency. The big question many of us ask today is: Does that come from doing one thing at a time or from multitasking? If we only do one thing at a time, can we ever hope to catch up?
- ❏ It takes more energy to shift your attention from task to task. It takes less energy to focus. That means that people who organize their time in a way that allows them to focus are not only going to get more done, but they'll be less tired and less neurochemically depleted after doing it. Daydreaming also takes less energy than multitasking. And the natural intuitive see-saw between focusing and daydreaming helps to recalibrate and restore the brain. Multitasking does not. Perhaps most important, multitasking by definition disrupts the kind of sustained thought usually necessary for problem solving and for creativity.
- ❏ Creative solutions often arise from allowing a sequence of altercations between dedicated focus and daydreaming.
- ❏ In multitasking, we unknowingly enter an addiction loop as the brain's novelty centers become rewarded for processing shiny new stimuli, to the detriment of our prefrontal cortex, which wants to stay on task and gain the rewards of sustained effort and attention.
- ❏ We need to train ourselves to go for the long reward, and forgo the short one.
- ❏ When we say that someone is focused, we usually mean they're attending to what is right in front of them and avoiding distraction, either internal or external. On the other hand, creativity often implies being able to make connections between disparate things.

- ❏ We consider a discovery to be creative if it explores new ideas through analogy, metaphor, or tying together things that we didn't realize were connected.
- ❏ There is an interesting gene known as COMT that appears to modulate the ease with which people can switch tasks, by regulating the amount of dopamine in the prefrontal cortex. COMT carries instructions to the brain for how to make an enzyme (in this case, catechol-O-methyltransferase, hence the abbreviation COMT) that helps the prefrontal cortex to maintain optimal levels of dopamine and noradrenaline, the neurochemicals critical to paying attention. Individuals with a particular version of the COMT gene (called Val158Met) have low dopamine levels in the prefrontal cortex and, at the same time, show greater cognitive flexibility, easier task switching, and more creativity than average.
- ❏ Individuals with a different version of the COMT gene (called Val/Val homozygotes) have high dopamine levels, less cognitive flexibility, and difficulty task switching.
- ❏ This converges with anecdotal observations that many people who appear to have attention deficit disorder—characterized by low dopamine levels—are more creative and that those who can stay very focused on a task might be excellent workers when following instructions but are not especially creative.
- ❏ This principle applies at all scales: If you have something big you want to get done, break it up into chunks—meaningful, implementable, doable chunks. It makes time management much easier; you only need to manage time to get a single chunk done. And there's neurochemical satisfaction at the completion of each stage.
- ❏ Then there is the balance between doing and monitoring your progress that is necessary in any multistep project. Each step requires that we stop the actual work every now and then to view it objectively, to ensure we're carrying it out properly and that we're happy with the results so far.
- ❏ We step back in our mind's eye to inspect what we did, figure out whether we need to redo something, whether we can move forward. It's the same whether we're sanding a fine wood cabinet, kneading dough, brushing our hair, painting a picture, or building a PowerPoint presentation.
- ❏ This is a familiar cycle: We work, we inspect the work, we make adjustments, we push forward. The prefrontal cortex coordinates the comparison of what's out-there-in-the-world with what's in your head.
- ❏ Reaching our goals efficiently requires the ability to selectively focus on those features of a task that are most relevant to its completion, while successfully ignoring other features or stimuli in the environment that are competing for attention.
- ❏ This is where expertise comes in—in fact, it could be said that what distinguishes experts from novices is that they know what to pay attention to and what to ignore.
- ❏ Movies use the cut in three different ways, which we've learned to interpret by experience. A cut can signify a discontinuity in time (the new scene begins three hours later), in place (the new scene begins on the other side of town), or in perspective (as when you see two people talking and the camera shifts from looking at one face to looking at the other).

- ❏ This allows new experiences to become integrated into a more generalized and hierarchical representation of the outside world that we hold inside our heads.
- ❏ Memory consolidation requires that our brains fine-tune the neural circuits that first encountered the new experience.
- ❏ The second kind of information processing we accomplish during sleep is assimilation. Here, the brain integrates new information into the existing network structure of other things you already knew.
- ❏ The third process is abstraction, and this is where hidden rules are discovered and then entered into memory. If you learned English as a child, you learned certain rules about word formation such as “add s to the end of a word to make it plural” or “add ed to the end of a word to make it past tense.” If you’re like most learners, no one taught you this—your brain abstracted the rule by being exposed to it in multiple instances. This is why children make the perfectly logical mistake of saying “he goed” instead of “he went,” or “he swimmed” instead of “he swam.”

Sleep

- ❏ Thus, many different kinds of learning have been shown to be improved after a night’s sleep, but not after an equivalent period of being awake. Musicians who learn a new melody show significant improvement in performing it after one night’s sleep. Students who were stymied by a calculus problem the day it was presented are able to solve it more easily after a night’s sleep than an equivalent amount of waking time.
- ❏ New information and concepts appear to be quietly practiced while we’re asleep, sometimes showing up in dreams. A night of sleep more than doubles the likelihood that you’ll solve a problem requiring insight.
- ❏ At a biological level, neurochemical tags are created and attached to experiences that are emotionally important; and those appear to be the ones that our dreams grab hold of.
- ❏ REM sleep is believed to be the stage during which the brain performs the deepest processing of events—the unitization, assimilation, and abstraction mentioned above.
- ❏ A preponderance of theta wave activity facilitates associative linking between disparate brain regions during REM. This has two interesting effects. The first is that it allows our brains to draw out connections, deep underlying connections, between the events in our lives that we might not otherwise perceive, through activating thoughts that are far-flung in our consciousness and unconsciousness.
- ❏ It’s what lets us perceive, for example, that clouds look a bit like marshmallows, or that “Der Kommissar” by Falco uses the same musical hook as “Super Freak” by Rick James. The second effect is that it appears to cause dreams in which these connections morph into one another: You dream you’re eating a marshmallow and it suddenly floats up to the sky and becomes a rain cloud; you’re walking down a street and suddenly the street is in a completely different town, and the sidewalk turns to water. These distortions are a product of the brain exploring possible relations

among disparate ideas and things. And it's a good thing they happen only while you're asleep or your view of reality would be unreliable.

- ❏ A normal human sleep cycle lasts about 90–100 minutes. Around 20 of those minutes on average are spent dreaming in REM sleep, and 70–80 are NREM sleep, although the length varies throughout the night. REM periods may be only 5–10 minutes at the beginning of the night and expand to 30 minutes or more later in the early morning hours. Most of the memory consolidation occurs in the first two hours of slow-wave, NREM sleep, and during the last 90 minutes of REM sleep in the morning. This is why drinking and drugs (including sleep medications) can interfere with memory, because that crucial first sleep cycle is compromised by intoxication. And this is why sleep deprivation leads to memory loss—because the crucial 90 minutes of sleep at the end is either interrupted or never occurs.
- ❏ If you've ever had a brain freeze—momentarily unable to remember something obvious—or if you've ever found yourself doing something silly like putting orange juice on your cereal, it may well be that part of your brain is taking a nap. Or it could just be that you're thinking about too many things at once, having overloaded your attentional system.
- ❏ Sleep is among the most critical factors for peak performance, memory, productivity, immune function, and mood regulation. Even a mild sleep reduction or a departure from a set sleep routine (for example, going to bed late one night, sleeping in the next morning) can produce detrimental effects on cognitive performance for many days afterward.
- ❏ For most of human history, our ancestors engaged in two rounds of sleep, called segmented sleep or bimodal sleep, in addition to an afternoon nap. The first round of sleep would occur for four or five hours after dinner, followed by an awake period of one or more hours in the middle of the night, followed by a second period of four or five hours of sleep. That middle-of-the-night waking might have evolved to help ward off nocturnal predators.
- ❏ Bimodal sleep appears to be a biological norm that was subverted by the invention of artificial light, and there is scientific evidence that the bimodal sleep-plus-nap regime is healthier and promotes greater life satisfaction, efficiency, and performance.
- ❏ AVERAGE SLEEP NEEDS: Age Needed sleep Newborns (0–2 months) 12–18 hours Infants (3–11 months) 14–15 hours Toddlers (1–3 years) 12–14 hours Preschoolers (3–5 years) 11–13 hours Children (5–10 years) 10–11 hours Preteens and Teenagers (10–17) 8 1/2–9 1/4 hours Adults 6–10 hours
- ❏ It is true that caffeine enhances cognitive function, but it works best when you've been maintaining a consistent sleep pattern over many days and weeks; as a substitute for lost sleep, it may keep you awake, but it will not keep you alert or performing at peak ability.
- ❏ One of the most powerful cues our body uses to regulate the sleep-wake cycle is light. Bright light in the morning signals the hypothalamus to release chemicals that help us wake up, such as orexin, cortisol, and adrenaline. For this reason, if you're having trouble sleeping, it's important to avoid bright lights right before bedtime, such as those from the TV or computer screen.

- ❏ Here are some guidelines for a good night's sleep: Go to bed at the same time every night. Wake up at the same time every morning. Set an alarm clock if necessary. If you have to stay up late one night, still get up at your fixed time the next morning—in the short run, the consistency of your cycle is more important than the amount of sleep. Sleep in a cool, dark room. Cover your windows if necessary to keep out light.
- ❏ People differ widely in their ability to take naps and in whether they find naps helpful. For those who do, they can play a large role in creativity, memory, and efficiency. Naps longer than about forty minutes can be counterproductive, though, causing sleep inertia. For many people, five or ten minutes is enough.
- ❏ Even five- or ten-minute "power naps" yield significant cognitive enhancement, improvement in memory, and increased productivity. And the more intellectual the work, the greater the payoff. Naps also allow for the recalibration of our emotional equilibrium—after being exposed to angry and frightening stimuli, a nap can turn around negative emotions and increase happiness.

Procrastination

- ❏ Following Mark Twain, Jake called it eating the frog: Do the most unpleasant task first thing in the morning when gumption is highest, because willpower depletes as the day moves on.
- ❏ Across the whole spectrum, all procrastination can be seen as a failure of self-regulation, planning, impulse control, or a combination of all three. By definition, it involves delaying an activity, task, or decision that would help us to reach our goals. In its mildest form, we simply start things at a later time than we might have, and experience unneeded stress as a deadline looms closer and we have less and less time to finish.
- ❏ Those who are younger and single (including divorced or separated) are slightly more likely to procrastinate. So are those with a Y chromosome—this could be why women are far more likely to graduate from college than men; they are less likely to procrastinate.
- ❏ Humans have a low tolerance for frustration. Moment by moment, when choosing what tasks to undertake or activities to pursue, we tend to choose not the most rewarding action but the easiest. This means that unpleasant or difficult things get put off.
- ❏ The low tolerance for frustration has neural underpinnings. Our limbic system and the parts of the brain that are seeking immediate rewards come into conflict with our prefrontal cortex, which all too well understands the consequences of falling behind. Both regions run on dopamine, but the dopamine has different actions in each. Dopamine in the prefrontal cortex causes us to focus and stay on task; dopamine in the limbic system, along with the brain's own endogenous opioids, causes us to feel pleasure.
- ❏ We put things off whenever the desire for immediate pleasure wins out over our ability to delay gratification, depending on which dopamine system is in control.
- ❏ Steel identifies what he calls two faulty beliefs: first, that life should be easy, and second, that our self-worth is dependent on our success. He goes further, to build an equation that quantifies the

likelihood that we'll procrastinate. If our self-confidence and the value of completing the task are both high, we're less likely to procrastinate. These two factors become the denominator of the procrastination equation.

- ❏ They are pitted against two other factors: how soon in time the reward will come, and how distractible we are. (Distractibility is seen as a combination of our need for immediate gratification, our level of impulsivity, and our ability to exercise self-control.) If the length of time it will take to complete the task is high, or our distractibility is high, this leads to an increase in procrastination.
- ❏ On the other hand, some individuals may be attempting a challenging task with which they have no previous experience; they may simply not know where or how to begin. In these cases, having supervisors or teachers who can help them break up the problem into component parts is very helpful and often essential. Adopting a systematic, componential approach to assignments is effective in reducing this form of procrastination.
- ❏ some individuals suffer from a chronic inability to finish projects they've started. This is not procrastination, because they don't put off starting projects; rather, they put off ending them. This can arise because the individual doesn't possess the skills necessary to properly complete the job with acceptable quality—many a home hobbyist or weekend carpenter can testify to this. It can also arise from an insidious perfectionism in which the individual has a deep, almost obsessive belief that their work products are never good enough (a kind of failure in satisficing).
- ❏ Also important is to disconnect one's sense of self-worth from the outcome of a task. Self-confidence entails accepting that you might fail early on and that it's OK, it's all part of the process. The writer and polymath George Plimpton noted that successful people have paradoxically had many more failures than people whom most of us would consider to be, well, failures.
- ❏ The internal dialogue of a successful (or eventually successful) person is more along the lines of "I thought I knew everything I needed to know to achieve my goals, but this has taught me that I don't. Once I learn this, I can get back on track."
- ❏ The kinds of people who become successful typically know that they can expect a rocky road ahead and it doesn't dissuade them when those bumps knock them off kilter—it's all part of the process.
- ❏ As Piers Steel would say, they don't subscribe to the faulty belief that life should be easy.
- ❏ The frontal lobes play a role in one's resilience to setbacks. Two subregions involved in self-assessment and judging one's own performance are the dorsolateral prefrontal cortex and the orbital cortex. When they are overactive, we tend to judge ourselves harshly.

Flow

- ❏ During the flow state, attention is focused on a limited perceptual field, and that field receives your full concentration and complete investment. Action and awareness merge. You cease thinking about yourself as separate from the activity or the world, and you don't think of your actions and

your perceptions as being distinct—what you think becomes what you do. There are psychological aspects as well. During flow, you experience freedom from worry about failure; you are aware of what needs to be done, but you don't feel that you are doing it—the ego is not involved and falls away completely.

- ❏ Anything that tempts us to break the extended concentration required to perform well on challenging tasks is a potential barrier to success. The change and novelty centers in your brain also feed you chemical rewards when you complete tasks, no matter how trivial.
- ❏ The greatest life satisfaction comes from completing projects that required sustained focus and energy. It seems unlikely that anyone will look back at their lives with pride and say with satisfaction that they managed to send an extra thousand text messages or check social network updates a few hundred extra times while they were working.
- ❏ For external distractions, the strategies already mentioned apply. Set aside a particular time of day to work, with the phone turned off and your e-mail and browser shut down. Set aside a particular place to work that allows you to focus. Make it a policy to not respond to missives that come in during your productivity time.
- ❏ Older adults (fifty-five to eighty) who walked for forty minutes three days a week showed significant increases in the size of their hippocampus, enhancing memory. Exercise has also been shown to prevent age-related cognitive decline by increasing blood flow to the brain, causing increases in the size of the prefrontal cortex and improvements in executive control, memory, and critical thinking.
- ❏ The solution is to follow the five-minute rule. If there is something you can get done in five minutes or less, do it now. If you have twenty things that would only take five minute each, but you can spare only thirty minutes now, prioritize them and do the others later or tomorrow, or delegate them. The point is that things you can deal with now are better off being dealt with, rather than letting them accumulate.
- ❏ after the age of thirty, our reaction time, cognitive processing speed, and metabolic rate slow down—the actual speed of neural transmission slows. This leaves the impression that the world is racing by, relative to our slowed-down thought processes.
- ❏ The way we choose to fill our time naturally changes across the life span as well. When we're young, we are driven by novelty and motivated to learn and experience new things. Our teens and twenties can be seen as a time when we want to learn as much about ourselves and the world as possible, so that we can come to know, out of an infinity of possibilities, what we like and how we'd like to spend our time. Am I someone who likes parachuting? Martial arts? Modern jazz? As we get older and approach our fifties and sixties, most of us place a higher priority on actually doing the things we already know we like rather than trying to discover new things we like.
- ❏ Artists recontextualize reality and offer visions that were previously invisible. Creativity engages the brain's daydreaming mode directly and stimulates the free flow and association of ideas, forging links between concepts and neural nodes that might not otherwise be made. In this way,

engagement in art as either a creator or consumer helps us by hitting the reset button in our brains. Time stops. We contemplate. We reimagine our relationship to the world.

- ❏ In contrast to creative thinking is rational decision-making. Unfortunately, the human brain didn't evolve to be very good at this, and evolutionary biologists and psychologists can only speculate why this might be so. We have a limited attentional capacity to deal with large amounts of information, and as a consequence, evolution has put into place time- and attention-saving strategies that work much of the time but not all of the time.

Organizing Information

- ❏ Most of us are ill-equipped to calculate such probabilities on our own. We're not just ill-equipped to calculate probabilities, we are not trained to evaluate them rationally. We're faced with decisions every day that impact our livelihood, our happiness, and our health, and most of these decisions—even if we don't realize it at first—come down to probabilities.
- ❏ Consider a forty-year-old woman who wants to have children. She reads that, compared to someone younger, she is five times more likely to have a child with a particular birth defect. At first glance, this seems like an unacceptable risk. She is being asked to pit her strong emotional desire for children against an intellectual knowledge of statistics. Can knowledge of statistics bridge this gap and lead her to the right conclusion, the one that will give her the happiest life?
- ❏ Busy people who make a lot of high-stakes decisions tend to divide their decision-making into categories, performing triage, similar to what I wrote about for list making and list sorting in Chapter 3: Decisions you can make right now because the answer is obvious Decisions you can delegate to someone else who has more time or expertise than you do Decisions for which you have all the relevant information but for which you need some time to process or digest that information. This is frequently what judges do in difficult cases. It's not that they don't have the information—it's that they want to mull over the various angles and consider the larger picture. It's good to attach a deadline to these. Decisions for which you need more information. At this point, either you instruct a helper to obtain that information or you make a note to yourself that you need to obtain it. It's good to attach a deadline in either case, even if it's an arbitrary one, so that you can cross this off your list.
- ❏ Calculable means we can assign precise values in a formula and generate an answer. Countable means we can determine the probabilities empirically by performing an experiment or conducting a survey and counting the results.
- ❏ Some probabilities of the objective type are difficult to calculate, but they are countable, at least in principle. For example, if a friend asked you the probability of drawing a straight flush—any sequence of five cards of the same suit—you might not know how to work this out without consulting a probability textbook. But in theory, you could count your way to an answer. You would deal cards out of decks all day long for many days and simply write down how often you get a straight flush; the answer would be very close to the theoretical probability of .0015% (15

chances in 1,000,000). And the longer you make the experiment—the more trials you have—the closer your counted observations are likely to come to the true, calculated probability. This is called the law of large numbers: Observed probabilities tend to get closer and closer to theoretical ones when you have larger and larger samples.

- ❏ Whereas objective probabilities involve a calculation from theory or counting from observation, the second kind of probability—the subjective—is neither calculable nor countable.

Organizing The Business World

- ❏ Up until the mid 1800s, businesses were primarily small and family-run, serving only a local market. The spread of telegraph and railroads beginning in the mid 1800s made it possible for more companies to reach national and international markets, building on progress in maritime trade that had been developing for centuries.
- ❏ Our fundamental doctrine for command requires trust throughout the chain of command. Superiors trust subordinates and empower them to accomplish missions within their intent. Subordinates trust superiors to give them the freedom to execute the commander's intent and support their decisions. The trust between all levels depends upon candor. . . . Army doctrine stresses mission command, the conduct of military operations that allows subordinate leaders maximum initiative. It acknowledges that operations in the land domain are complex and often chaotic, and micromanagement does not work. Mission command emphasizes competent leaders applying their expertise to the situation as it exists on the ground and advancing the mission based on their commander's intent. Mission command fosters a culture of trust, mutual understanding, and a willingness to learn from mistakes. . . . Commanders . . . provide subordinates as much leeway for initiative as possible while keeping operations synchronized.
- ❏ Making ethical or moral decisions involves distinct structures within the frontal lobes: the orbitofrontal cortex (located just behind the eyes) and the dorsolateral prefrontal cortex just above it. These two regions are also required for understanding ourselves in relation to others (social perception), and the compliance with social norms. When damaged, they can lead to socially inappropriate behavior such as swearing, walking around naked, and saying insulting things to people right to their faces. Making and evaluating ethical decisions also involves distinct subregions of the amygdala, the hippocampus (the brain's memory index), and the back portion of the superior temporal sulcus, a deep groove in the brain that runs from front to back behind the ears. As with economic decisions involving costs and benefits, the prefrontal cortex acts as the decider between the moral actions being contemplated.
- ❏ monkeys have a highly developed sense of what is and is not equitable. In one study, brown capuchin monkeys who participated in an experiment with another monkey could choose to

reward only themselves (a selfish option) or both of them (an equitable, prosocial option). The monkeys consistently chose to reward their partner.

- ❏ psychologist Howard Gardner includes individuals who significantly affect the thoughts, feelings, or behaviors of a significant number of individuals indirectly, through the works they create—these can be works of art, recipes, technological artifacts and products . . . almost anything.
- ❏ They tend to be adaptable and responsive, high in empathy, and able to see problems from all sides. These qualities require two distinct forms of cognition: social intelligence and flexible, deep analytic intelligence. An effective leader can quickly understand opposing views, how people came to hold them, and how to resolve conflicts in ways that are perceived to be mutually satisfying and beneficial. Leaders are often adept at bringing people together—suppliers, potential adversaries, competitors, characters in a story—who appear to have conflicting goals. A great business leader uses her empathy to allow people or organizations to save face in negotiations so that each side in a completed negotiation can feel they got what they wanted (and a gifted negotiator can make each side feel they got a little bit more than the other party). In Gardner's model, it is no coincidence that many great leaders are also great storytellers—they motivate others around them with a compelling narrative, one that they themselves embody. Leaders show greater integration of electrical activity in the brain across disparate regions, meaning that they use more of their brain in a better-orchestrated fashion than the rest of us. Using these measures of neural integration, we can identify leaders in athletics and music, and in the next few years, the techniques promise to be refined enough to use as screening for leadership positions.
- ❏ negative leadership can be toxic, resulting in the collapse of companies or the loss of reputation and resources. It is often the result of self-centered attitudes, a lack of empathy for others within the organization, and a lack of concern for the organization's long-term health.
- ❏ The latest version of their Mission Command manual outlines five principles that are shared by commanders and top executives in the most successful multinational businesses: Build cohesive teams through mutual trust. Create shared understanding. Provide a clear and concise set of expectations and goals. Allow workers at all levels to exercise disciplined initiative. Accept prudent risks.
- ❏ Managers who hide this purpose from underlings, out of a misguided sense of preserving power, end up with unhappy employees who perform their jobs with tunnel vision and who lack the information to exercise initiative.
- ❏ Prudent risk is the deliberate exposure to a negative outcome when the employee judges that the potential positive outcome is worth the cost. It involves making careful, calculated assessments of the upsides and downsides of different actions.
- ❏ There are things that managers can do to improve productivity, based on recent findings in neuroscience and social psychology. Some of these are obvious and well known, such as setting clear goals and providing high-quality, immediate feedback. Expectations need to be reasonable or employees feel overwhelmed, and if they fall behind, they feel they can never catch up. Employee productivity is directly related to job satisfaction, and job satisfaction in turn is related to whether

employees experience that they are doing a good job in terms of both quality and quantity of output.

- ❏ If we can predict some (but not all) aspects of how a job will go, we find it rewarding. If we can predict all aspects of the job, down to the tiniest minutiae, it tends to be boring because there is nothing new and no opportunity to apply the discretion and judgment that management consultants and the U.S. Army have justly identified as components to finding one's work meaningful and satisfying.
- ❏ there is a critical point about differences between individuals that exerts arguably more influence on worker productivity than any other. The factor is locus of control, a fancy name for how people view their autonomy and agency in the world. People with an internal locus of control believe that they are responsible for (or at least can influence) their own fates and life outcomes. They may or may not feel they are leaders, but they feel that they are essentially in charge of their lives. Those with an external locus of control see themselves as relatively powerless pawns in some game played by others; they believe that other people, environmental forces, the weather, malevolent gods, the alignment of celestial bodies—basically any and all external events—exert more influence on their lives than they themselves do.
- ❏ Employees who have an external locus of control believe their own actions will not lead to the attainment of rewards or the avoidance of punishment, and therefore, they don't respond to rewards and punishments the way others do. Higher managers tend to have a high internal locus of control.
- ❏ Internals tend to be higher achievers, and externals tend to experience more stress and are prone to depression. Internals, as you might expect, exert greater effort to influence their environment (because, unlike externals, they believe their efforts will amount to something). Internals tend to learn better, seek new information more actively, and use that information more effectively, and they are better at problem solving.
- ❏ Internals tend to exhibit less conformity than externals, and less attitude change after being exposed to a persuasive message. Because internals are more likely to initiate changes in their environment, they can be more troublesome to supervise. Moreover, they're sensitive to reinforcement, so if effort in a particular job doesn't lead to rewards, they may lose motivation more than an external, who has no expectation that his or her effort really matters anyway.
- ❏ "Externals make more compliant followers or subordinates than do internals, who are likely to be independent and resist control by superiors and other individuals. .
- ❏ The combination of high autonomy and an internal locus of control is associated with the highest levels of productivity.
- ❏ workers who are self-motivated, proactive, and creative may find jobs with a lack of autonomy to be stifling, frustrating, and boring, and this may dramatically reduce their motivation to perform at a high level. This means that managers should be alert to the differences in motivational styles, and take care to provide individuals who have an internal locus of control with autonomous jobs, and individuals who have an external locus of control with more constrained jobs.

- ❏ Related to autonomy is the fact that most workers are motivated by intrinsic rewards, not paychecks. Managers tend to think they are uniquely motivated by intrinsic matters such as pride, self-respect, and doing something worthwhile, believing that their employees don't care about much other than getting paid. But this is not borne out by the research. By attributing shallow motives to employees, bosses overlook the actual depth of their minds and then fail to offer their workers those things that truly motivate them.
- ❏ Other factors contribute to productivity, such as being an early riser: Studies have shown that early birds tend to be happier, more conscientious and productive, than night owls. Sticking to a schedule helps, as does making time for exercise.
- ❏ We all bet high multitaskers were going to be stars at something. We were absolutely shocked. We lost all our bets. It turns out multitaskers are terrible at every aspect of multitasking. They're terrible at ignoring irrelevant information; they're terrible at keeping information in their head nicely and neatly organized; and they're terrible at switching from one task to another.
- ❏ You'd think people would realize they're bad at multitasking and would quit. But a cognitive illusion sets in, fueled in part by a dopamine-adrenaline feedback loop, in which multitaskers think they are doing great. Part of the problem is that workplaces are misguidedly encouraging workers to multitask.
- ❏ Many managers impose rules such as "You must answer e-mail within fifteen minutes" or "You must keep a chat window open," but this means you're stopping what you're doing, fragmenting concentration, Balkanizing the vast resources of your prefrontal cortex, which has been honed over tens of thousands of years of evolution to stay on task.
- ❏ if the consumer can choose which parameters to receive information about, as well as how much, they make better decisions.
- ❏ This is primarily because the consumer can choose information that is relevant to them or that they are best able to understand.
- ❏ The Russian mathematician Andrey Kolmogorov introduced an influential idea about this. He said that a string is random if there is no way to describe it or represent it in an abbreviated form.
- ❏ The more structured a system is, the less information required to describe it. Conversely, more information is required to describe a disorganized or unstructured system. At the extreme, the most disorganized system possible is a random arrangement of everything—because there is no pattern whatsoever in a random system, each element needs to be described individually. This requires an enormous amount of communication
- ❏ In general, a business that is highly structured is more resilient under stress. If a manager leaves her job, smooth, continuous operation of the company is achieved if the replacement can step into a well-defined job with clear reporting structure and fewer ad hoc arrangements.
- ❏ The root problem, Lawrence Sanger says, is a "lack of respect for expertise." As one Wikipedia commentator noted, "Why would an expert bother contributing his valuable time to a project that can be ruined by any random idiot on the net?"

What To Teach To Our Children?

- ❏ Fish oil, rich in omega-3 fatty acids, has been found to be protective against cardiovascular disease, and the American Heart Association has been recommending the consumption of fish twice a week and the supplementation of fish oil capsules, for over ten years.
- ❏ One of the most important tools in critical thinking about numbers is to grant yourself permission to generate wrong answers to mathematical problems you encounter. Deliberately wrong answers! Engineers and scientists do it all the time, so there's no reason we shouldn't all be let in on their little secret: the art of approximating, or the "back of the napkin" calculation. Such deliberately wrong answers can get you close enough to the right answer to make a decision in just a fraction of the time. As the British writer Saki wrote, "a little bit of inaccuracy saves a great deal of explanation."
- ❏ There are three ways we can learn information—we can absorb it implicitly, we can be told it explicitly, or we can discover it ourselves. Implicit learning, such as when we learn a new language through immersion, is usually the most efficient. In classroom settings and at work, most information is conveyed in one of the two latter ways—being told explicitly or discovering ourselves.
- ❏ A striking parallel distinction was found in a study of children's television shows. Angeline Lillard and Jennifer Peterson of the University of Virginia had four-year-olds watch just nine minutes of SpongeBob SquarePants cartoons, a fast-paced television program, versus watching the slower-paced public television cartoon Caillou, or drawing pictures on their own for nine minutes. They found that the fast-paced cartoon had an immediate negative impact on children's executive function, a collection of prefrontal cortical processes including goal-directed behavior, attentional focus, working memory, problem solving, impulse control, self-regulation, and delay of gratification. The researchers point not just to the fast pace itself, but to the "onslaught of fantastical events" which are, by definition, novel and unfamiliar. Encoding such events is likely to be particularly taxing on cognitive resources, and the fast pace of programs like SpongeBob don't give children the time to assimilate the new information. This can reinforce a cognitive style of not thinking things through or following new ideas to their logical conclusion.
- ❏ The tentative and intriguing take-home message is that reading high-quality fiction and literary nonfiction, and perhaps listening to music, looking at art, and watching dance, may lead to two desirable outcomes: increased interpersonal empathy and better executive attentional control.

Everything Else

- ❏ the most fundamental principle of organization, the one that is most critical to keeping us from forgetting or losing things, is this: Shift the burden of organizing from our brains to the external world. If we can take some or all of the process out of our brains and put it into the physical world, we are less likely to make mistakes.

- One- and two-digit highway numbers less than 100 identify major routes (e.g., 1, 5, 70, 93) that cross state lines. Even numbers are east-west routes, odd numbers are north-south. Even numbers increase as they move from south to north; odd numbers increase as they move from west to east. Route numbers that are multiples of 5 are major arteries that extend over long distances. For example, I-5 is the westernmost major artery carrying north-south traffic between Canada and Mexico; I-95 is the easternmost major artery carrying north-south traffic between Canada and Florida. I-10 is the southernmost major artery carrying west-east traffic from California to Florida, and I-90 is the northernmost, carrying west-east traffic from Washington State to New York State. Three-digit numbers identify loops, or auxiliary, supplementary routes in or around a city. If the first digit is even, it is a route through or around a city that breaks off of and eventually rejoins the main route. If the first digit is odd, it is a spur into or out of a city and does not rejoin the main route (if you're afraid of getting lost, the auxiliary highways with an even-numbered first digit are thus always a safer bet). Generally, the second and third digits refer to the principal interstate served by the three-digit route. For example, if you are in Northern California and you find yourself on something called I-580, you can deduce the following:
- There is a peculiar irony in all of this: Small libraries are far more useful than large ones. The Library of Congress may have one copy of every book ever published, but it is very unlikely that you will serendipitously find a book you did not know about and that will delight you. There is just too much there. A small library, carefully curated and tended by a librarian, will have made some deliberate choices about what books to include. When you reach for a copy of one book, you'll see books adjacent on the shelf that may spark your interest, or you may find your eye caught by a title in a completely separate, unrelated section of the library and start browsing there. No one browses the Library of Congress—it is too massive, too complete.
- Another thing that has been lost with digitization and free information is an appreciation for the objects in a collection. A person's music library was once, not so long ago, a collection to admire, possibly envy, and a way to learn something about its owner. Because record albums had to be purchased one by one, because they were relatively expensive and took up space, music lovers compiled such libraries deliberately, with thought and planning.
- selection. There are really only two strategies for selection in the face of this—searching and filtering. Together these can be more parsimoniously thought of as one strategy, filtering, and the only variable is who does the filtering, you or someone else. When you search for something, you start out with an idea of what you want, and you go out and try to find it. In the Internet age, "go out" may not be more than typing a few keystrokes on your laptop while you sit propped up in bed with your slippers on, but you are effectively going out into the digital world to find what you're looking for. (Computer scientists call this pull because you are pulling information from the Internet, as opposed to push, where the Internet automatically sends information to you.) You or your search engine filter and prioritize the results, and if all goes well, you have what you're looking for instantly. We tend not to keep a copy of it, virtual or physical, because we know it will be there later for us when we need it. No curating, no collecting, and no serendipity.

- ❏ This is a downside to digital organization, and it makes opportunities to daydream perhaps more important than ever. “The greatest scientists are artists as well,” said Albert Einstein. Einstein’s own creativity arrived as sudden insight following daydreaming, intuition, and inspiration. “When I examine myself and my methods of thought,” he said, “I come close to the conclusion that the gift of imagination has meant more to me than any talent for absorbing absolute knowledge. . . . All great achievements of science must start from intuitive knowledge. I believe in intuition and inspiration. . . . At times I feel certain I am right while not knowing the reason.” The importance of creativity to Einstein was encapsulated in his motto, “Imagination is more important than knowledge.”
- ❏ art, technology, or science alone cannot solve problems, the combination of the three is perhaps the most powerful of all. The ability of technology, when properly guided, to solve intractable global problems has never been higher.