9

Executive Functions

The Seven Abilities That Make Up Self-Control . . . and More

"Why does it take me 2 hours to write a business letter that other people can write in 10 minutes? I can't seem to get my ideas to flow in this nice orderly sequence to write down what I want to say."

"I have a terrible time controlling my emotions, especially if something happens that frustrates or upsets me. One of the many times I locked my keys in my car and really had to get somewhere important for my job, I got so angry at myself that I started to tear the door off the car. People driving by must have been staring at me and thinking 'That guy is really crazy!' but I didn't care."

- ✓ Chapter 7 showed that we use inhibition to delay the decision to respond to an event—to wait.
- ✓ Chapter 8 showed that this delay gives us time to engage in self-control. Self-control, or better yet, self-regulation, allows us to monitor our own actions, stop ourselves as needed, contemplate our possible actions, and then choose the wisest course of action to get the best possible outcome in the future.
- ✓ But *how* do we control ourselves? What allows us to use the time created by resisting an impulse wisely? That's the subject of Chapter 9.

Scientists in the field of neuropsychology call the capacities behind self-control the *executive functions,* or sometimes executive abilities. They're the actions directed at ourselves, the mental activities we engage in when we think about our future and what we should be doing to get there and to make it better.

Different scientists have conceptualized executive functions differently, but what you'll read here is the view I've developed. (It is, after all, my book.)

Research now suggests that there are at least six other executive functions *besides inhibition*—a total of seven different actions we use to monitor our own behavior, stop ourselves, think things over, and guide our eventual behavior while controlling our emotions and motivations to optimize our success at attaining our goals. We use these actions for the single purpose of controlling our own behavior to achieve a better future:

- ✓ Self-awareness
- ✓ Inhibition
- ✓ Nonverbal working memory
- ✓ Verbal working memory
- ✓ Emotion regulation
- ✓ Self-motivation
- ✓ Planning/problem solving

Knowing which of your executive functions is the weakest will help you understand which type of self-control to target in efforts to cope and compensate.

Here's how they develop:

✓ *Executive functions are more obvious in children and more internalized in adults.* We're hardly aware of these mental machinations. No one can really see us engaging in them. They're the things we adults "do in our heads" all day long as we choose what to do in every situation. They are what most of us refer to simply as "thinking." Yet I believe all seven are entirely obvious, public behavior early in child development. Executive functions were likely also public or obvious early in human evolution, when the human brain was much more primitive, but that's a story for my other book on executive functions. As we mature, we internalize them, like the species probably did as it evolved.

Think of it this way: People develop an ability to engage in some action to themselves, like talking out loud to themselves to control their actions. Eventually, these are no longer observable and occur just in the brain, like having an idea. We say these actions are now "internalized," as we are able to inhibit those signals from leaving the brain, entering the spinal cord, and activating the actual behavior. You can now imagine doing something without then actually doing it physically. We come to "privatize" this process, probably through a simple switch deep in the brain that can prevent a thought from being activated via the spinal cord as a behavior. This internalizing or privatizing process creates a private form of action that we usually call "thinking."

Notice that this process involves inhibition; the thought can go on, but the action it might create is prevented from occurring. Now you know why people with ADHD often act out their thoughts impulsively instead of keeping them

in their mind (brain) for further evaluation before finally implementing them. If you are into high-tech gadgetry, you know about simulators. They let us do things in a virtual world without really doing them in the real world. Well, that's what this process of privatizing our actions lets us do—we get to simulate our ideas and plans before we actually implement them to see how they might play out and get to learn from such mental simulations. If we couldn't do that, we would likely experience more mistakes, failures, and injuries, and a greater likelihood of death, all of which are real risks for people with ADHD.

These familiar examples will illustrate what I mean:

- Six-year-old Lena puts her hand over her mouth when she wants to tell a secret that her friends just told her not to. At age 16, she won't need the physical restraint; she'll just visualize doing so in her mind and maybe use internal self-talk to stop herself even if she really wants to tell.
- Eight-year-old Rico softly but audibly repeats to himself, "Stay inside the lines" and "Don't push too hard on the pencil" during classroom writing assignments to keep himself focused on the teacher's rules and reminders. When he's older, he'll be able to use his "mind's voice" to say such things to himself so automatically that he may not even be aware that he's issuing his own silent reminders.
- Crissy and her classmates start out using their fingers, some beads, and then a number line on their desk to carry out the steps to solve a math problem. As they mature, they'll be able to complete problems using mental rather than manual manipulation. They can visualize manipulating the beads or moving their hand along a number line without really doing that in the real world.

Adults with ADHD report that they need to use tactics that fall in between obvious, public self-reminders and the nearly automatic mental reminders that other adults give themselves. One adult said he locks his mouth with an invisible key to get himself to stop talking. Do you use tricks like that to control your behavior?

_____

_____

_____

_____

✓ Executive functions operate together but can cause impairments *separately.* Other scientists and I have divided executive functioning into seven separate abilities to understand them better. But we humans don't experience them as separate, nor do we use them one at a time as adults. The executive functions operate like the sections of a symphony orchestra, playing simultaneously to produce seamlessly beautiful music. It is the action of these executive functions *in concert* that permits normal human self-control. When ADHD enters the picture, so do deficits in executive functions. These deficits might occur more in one executive function than in the others, producing different types of behavior problems with self-control in different adults with ADHD. This means *there are really seven executive functions or seven different types of self-control and so seven different kinds of deficits in ADHD.* Knowing which one is the biggest problem for you makes it easier to choose external tools and strategies that can make up for those internal deficits. Later in the chapter, you'll have a chance to review the problems listed under each executive function to get an idea of where your biggest problems lie.

✓ *The seven executive functions develop one at a time, in sequence, each added to the earlier ones to build a mental structure, like a Swiss Army knife, that gives us a set of mind tools that facilitate our self-control.* As each executive function develops in a child, control over the child's behavior gradually shifts in four important ways that should ultimately add up to adult self-determination:

- *From external to internal:* We all start out as babies being controlled by purely external events—a loud noise, a mother's departure, a wet diaper, or, much later, the commands and directives of our parents—and then we become increasingly managed by internal forms of information, much of which deals with the past and future (images, self-speech, motivation, and so forth, which make up our hindsight and foresight).
- *From others to the self:* At first, we need to be controlled and managed entirely by others (such as parents), gradually becoming able to better control ourselves.
- *From the present to the future:* When very young, the only thing that matters to us is what's happening right now. Throughout childhood we become increasingly aware of and directed toward future events. Think of how long you'd expect a typical 3-year-old to think ahead and plan out her day compared to how far in advance a 14-year-old should be able to do it (a day or two) and then for what period a 36-year-old should be able to do so (6–12 weeks ahead).
- *From instant gratification to deferred gratification:* More and more as we mature, we find the big prize at the end of the long haul to be worth

waiting and working for and so turn away from the small seductions and rewards of the moment to work for those much bigger rewards.

Think of what people usually mean when they call adults "childish." The barbs usually start flying at adults who seem ruled by whatever is going on around them, who need other adults to do their thinking for them, who don't think ahead, and who have no patience.

Sound at all familiar? Does an example from your own life come to mind?

As an adult with ADHD, you've been subjected to delayed development of each of the seven executive functions. You're no child, but these lags make you less effective than other adults and may make your peers treat you as if you were a child. You can head off blame (including self-blame) and help yourself make these shifts from child to adult functioning more fully if you know a little more about how the condition disables each executive function.

Self-Awareness—Using the Mind's Mirror

Even though I focused so heavily on inhibition above because it is so essential to self-control, it is actually not the first executive function to develop. Self-awareness is the first executive function to emerge in childhood. It goes hand in glove with inhibition because neither one makes any sense without the other right alongside it, which means they both likely develop together or at least very close in time. The other five executive functions would be useless without these first two: If you are unaware of how you are behaving, why would you and how could you stop yourself from behaving the way you're behaving? And if you don't monitor your behavior and change it as necessary, you're also not likely to spend time thinking about your past and future, how they can inform your decisions going forward, and even what goals you want to achieve.

That is actually what the vast majority of other species of animals do on this planet. They are stimulus-response creatures, reacting to the moment as events overtake them and adjusting their behavior only after the fact as a result of the consequences—if they survive them. But not us. For we humans know that simply reacting is not what is best for us if we want to optimize our *long-term* welfare, quality of life, and even survival over our short-term actions and their immediate rewards.

First We Need to Be Aware of Our Surroundings

After we are born, our first order of business in development is to start to attend to our surroundings and then begin to orient our motor responses to the things that we detect are happening to us. We then start to adjust our next response based on the actual consequences of what we do. All animal species do this, because if they don't, they won't survive for very long as adults.

Then We Need to Be Aware of Ourselves

But very soon after developing such outer-directed attention and behavior, human children turn that process of attention to themselves. After all, they and their behavior are also part of the world they inhabit, and so it makes sense that they should begin to become self-aware. As this ability emerges, we, unlike the vast majority of other creatures, can see our reflection in a mirror and recognize ourselves. This mirror test is precisely what is used by scientists to determine if a species is self-aware and also when in human infancy this awareness starts to develop.

One likely reason we develop self-awareness and other creatures don't is that we are one of a rare handful of species that survive by living in groups with others, some of whom are kin *but others of whom are not!* You probably don't realize just how very special living in that niche is. Most other social creatures don't live with beings they are not genetically related to, but we, chimps, dolphins, and a very few other animals do. To do so requires some sort of frontal-lobe executive system for tracking them and monitoring how we reciprocate with them as well as how they reciprocate with us. Working memory, to be discussed later, is well suited for doing just this.

In the niche of rare social species that live with non-kin, it becomes important to monitor what you do, how others react to it, and whether they repay the favor. We then adjust our behavior accordingly so that we can alter what we do before we do it. We routinely depend on others, including non-kin within our tribe, for our survival. But we don't naively trust everyone, because non-kin do not always have our best interests at heart the way biological family members usually do. Thus how we control ourselves—to improve our social interactions, networks,

and welfare, sharing with the trustworthy reciprocators while quickly detecting and avoiding the cheaters and exploiters—gives us a competitive advantage over others (and other species) that are not doing so.

What Does This Mean for People with ADHD?

Regardless of its initial evolutionary function, self-awareness is so crucial to human survival and social success that we frequently take it for granted. But when a disorder like ADHD undermines this basic executive function of self-awareness, it can undermine the entire system of self-regulation and its purpose. A deficit in that executive function means you have less awareness of how you're acting, how your behavior is coming across to others around you, and what the predictable consequences would be for acting that way. You have more difficulty directing your attention to yourself than others do. This may lead you to barge into social situations or be offensive without realizing it, and not to notice how others around you are reacting. Both adults and children with ADHD are often less aware than others of how loudly they're talking, how much they're talking, what they're trying to say, how much they're moving while saying it, why they're even saying it (rambling and forgetting their goals), and especially how others are reacting to what they're saying. Three of the ADHD symptoms in the DSM-5 diagnostic criteria in the Appendix (and the only ones representing impulsiveness) illustrate precisely this problem of verbal heedlessness.

Now extend this poor self-monitoring to other types of behavior and especially social interactions besides verbal ones and you can see the myriad social problems this limited self-awareness can create for you. Compound this deficit further by the fact that you might not realize how emotional you're becoming during some social exchanges, and you can see how your social life can go off the rails very quickly. Unfortunately, those with whom you're interacting don't necessarily know you have ADHD—or understand its role in causing your behavior—and may see you as immature, self-centered, or egotistical. They don't understand that you can't stop yourself if you can't monitor what you're doing and how it is playing out with others.

This poses a sizable problem for both loved ones who can see what you cannot see—that your behavior may at times be inappropriate and that others are judging you negatively for it—and professionals who deal with adults with ADHD: How can they help someone who doesn't know he has a problem or doesn't think it's significant enough to be addressed? It is for this very reason that a new requirement was added to the DSM-5 diagnostic criteria: Now clinicians must corroborate the reports of what the patient is saying with others who know the patient well or, if not available, with archival school and other records that may reflect how impaired the patient's functioning is. Until age 30 or older, even adults with

ADHD cannot be trusted to be the sole judge of their own behavior, symptoms, or impairments; they simply do not have the necessary self-awareness to make accurate self-assessments. You may feel belittled by a helping professional who gathers information from others on your behavior rather than trusting your own reports. Try to understand that the professional is following guidelines that will help diagnose your problems and lead to treatment. The deficit in self-awareness can obviously cause you a lot of problems. It may delay your recognition or acceptance of the fact that you have a disorder—and in turn delay your seeking or receiving the help you need and deserve. It doesn't have to be that way.

Nonverbal Working Memory: Using the Mind's Eye

Nonverbal working memory is the third executive function to develop, just shortly after your ability to monitor your own actions and then to inhibit the immediate urges to act. It's the capacity to hold information in mind—not through words but through your senses. So this executive function allows you to hold in your head pictures, sounds, tastes, touches, and scents. Because vision is our most important sense for survival, nonverbal working memory largely represents the ability to engage in visual imagery—to "see to yourself" in your mind's eye. A close second in importance is hearing, so we can also "hear to ourselves" using nonverbal working memory. More accurately, we resee past events and rehear past sounds and the things others have said to us. But we can also resense all of our other senses if we need to, such as smell (when I recall the aroma of a good wine or scent of a favorite flower), or taste (as when I recall or retaste my favorite lamb or salmon dish), or even refeel the soft texture of my favorite flannel shirt on my neck and arms. It's all resensing in our mind as we recall these past sensations. So while I focus here on visualizing and rehearing things in our mind, don't forget we can do that with our other senses too.

How Nonverbal Working Memory Guides Us

1. **We get a map that leads us to the future we want.** Seeing to ourselves means reseeing past relevant events. What we've seen sometime in the past we can see again in our head, thanks to this executive function. What we've heard before we can hear again, also in our head. Resensing past experience, which constitutes our "ideas," creates an internal stream of information through our mind that we can use to guide our behavior across time toward a goal. By envisioning our past, we can foresee a possible future. It works just like the GPS in your car. The device brings up a map of your region and allows you to use it to get to a

particular destination, which is your goal. Images of past relevant events are the maps that we can use to guide us to our goal.

2. We gain the powerful tool called *imitation*. When you can hold an image in your mind of what you have seen and experienced, especially if it involved watching another person do something novel, you also now have the power to imitate the behavior of others. Instead of having to go through the hard knocks of trial-and-error learning in every new situation to come up with that new way of doing something, you can call up your mental picture of how Dad or your best friend handled a particular problem beautifully. And then you just copy that image of what they did. No trial and error, no failure and frustration, and no harm to ourselves. Imitation gives us a cheap and easy way to acquire new behavior without learning it directly. We just "photocopy" what we saw someone else do. How cool is that? It's important to understand that when you learn through nonverbal working memory, you don't necessarily copy the other person's actions literally but rather copy your image of those actions. The image is a template you can use to copy what they did. Yet you always put your own spin on what you learn from others. Nonverbal working memory also enables you to do the opposite of what others have done rather than imitate them in everything they do, when what you saw them do failed or resulted in errors, punishment, or harm. You just do the opposite or do nothing at all and thus avoid whatever harms befell them. Imitation, or more accurately vicarious learning, lets us take the best of what other people have learned to do while avoiding the worst of their own mistakes, thus making for a very efficient form of social learning that humans have elevated to an art form during their evolution. Now imagine how inefficient and even harmful learning will be if you don't use nonverbal working memory very well if at all. We see such problems in people with ADHD, who seem to benefit less than most people from what they see others doing around them.

Nonverbal working memory allows not only imitation but the opposite: staying away from what someone else did that proved ineffective. This is called *vicarious learning.*

3. We can foresee the consequences of our actions. Chapter 8 explained that self-control depends on both hindsight and foresight: We need to be able to see in our mind's eye both our past experiences and any pattern that sheds

Hindsight → Foresight → Preparation to act

light on our likely future experiences. Hindsight brings your pertinent past history forward into the moment to inform you of the best way to behave given what happened to you before. Foresight, or forethought, means taking any patterns perceived in images from the past to anticipate what will happen in the future.

4. We gain self-awareness. We use our visual imagery to study our past, or even just to hold our immediate past behavior in mind, so we can monitor our own actions. Then we can compare them against what our plans, goals, and strategies were and evaluate how well we are doing in performing that task or achieving our goals. We gain a greater self-awareness of our life across time.

5. We're capable of sensing the flow of time and thus managing ourselves relative to it. The ability to hold a sequence of past events in our mind and refer to them across time appears to give us a *sense of time* itself, how it is flowing or progressing, and how best to manage our behavior relative to it. We understand how much time may have passed, how much we have left, and what we need to do when necessary to get tasks done on time. We can judge how long something might take, such as driving to work on a rainy morning, and thus plan our departure so as to get to work on time. This capacity to sense and judge the flow of time and manage ourselves relative to it, which we call *time management,* is one of the strongest predictors of educational and occupational success.

Nonverbal working memory gives us a sense of time, a key to time management.

6. We learn to defer gratification. To value a delayed consequence, you must have a sense of the future and use it to guide your behavior. The more you use that sense, the more likely you are to focus on the big rewards down the road rather than the immediate, smaller prizes.

7. We can see further and further ahead. As hindsight and forethought develop, we gain an expanding window on time (past, present, future) in our conscious mind. It even gives us our subjective sense of time and its passing. Small children can't see much past a few minutes ahead. And they can't judge time intervals very well, much less use them to coordinate their actions. But by adulthood (ages 20–30), behavior is typically organized to deal with events 8–12 weeks ahead, and our sense of the flow of time is almost continuously informing our decisions and actions. And this time horizon can be extended further into the future if the consequences associated with those events are particularly crucial to us.

8. We value cooperation and sharing. The golden rule may not seem like an obvious product of nonverbal working memory or visualizing to yourself. But when you think about it, it makes perfect sense. With a grasp of the past, you

remember what others have done for you and you for them, and with your sense of the future you realize that sharing and social cooperation insure you against possible shortfalls of resources. Therefore you're willing to give up and share some excess resources now with a less fortunate friend or family member in the hope that the recipient will share abundance with you later, when you may need it. This voluntary and reciprocal form of altruism is what makes social groups so effective in surviving and competing against less cooperative individuals or groups. Selective and voluntary sharing with like-minded people in our social group is like an insurance policy against future misfortunes in life.

Nonverbal working memory may be what makes selfish altruism part of human nature.

How ADHD Interferes with Nonverbal Working Memory

To get an idea of which type of self-control you might target when selecting strategies from Steps Four and Five, think about which of the following are the biggest problems for you.

✓ *You have little or no feel for the passage of time, have trouble judging how much time activities will take, and cannot manage yourself well relative to the passage of time.* When nonverbal working memory and its related sense of time are disturbed by ADHD, it can leave an adult without a typical sense of time. All that seems to matter to you is what is happening now. So you live much of your life in the now rather than getting ready for what is going to happen next. It can also leave you with a sense that time is passing much more slowly than it really is. This can make you feel like you have a lot more time to get things done than you actually have. It may cause you to waste time doing things that are irrelevant to your goals or tasks. Events, deadlines, or the future itself generally arrive much sooner than expected and catch you off guard, often leaving you in a panic or a crisis.

✓ *You can't reactivate a large number or wide variety of past events.* Typically, the more children mature, the greater the number and variety of past events they can conjure up. But the lags caused by ADHD keep the capacity for visual imagery and reheard experiences fairly primitive. This deficit in nonverbal working memory creates a major gap in the resources that adults with ADHD have to guide their behavior compared to typical adults. So to others you might look like you don't think before you act. It would be more accurate to say you have trouble *remembering*—or more accurately, *resensing*—before you act.

Sam is known to friends as tactless because he blurts out whatever comes to mind; he can't read social cues because he doesn't attend to them and thus has no archive

of such images to serve as a repertoire of subtle facial expressions and what they communicate.

✓ *Long, complicated sequences of behavior may pose a serious challenge for you.* Knowing how to behave in delicate social situations, sticking with the rules of a complex game, completing a multistep task like filing a tax return—all of these typical adult scenarios may leave you with no clue because your brain has difficulty holding all those mental images.

Sebastian's hyperactivity as a child kept him out of the team sports he loved, so he thought he'd join the company softball team to make up for lost time. He no longer got tagged out for constantly leading off a base, but from inning to inning he'd forget how the opposing players hit, who was a fast runner, what the status of the game was, and how his own team members fielded. So he was always in the wrong place at the wrong time and led his team in errors. After being benched for a couple games he quit the team.

✓ *Vicarious learning may not be so available to you.* If you have trouble learning from the successes and mistakes you've observed in others, you're stuck learning everything the slow, painful way: by yourself, on your own, through trial and error.

Claire's coworkers sometimes wondered whether she was taking drugs. Otherwise, how could she have failed to notice the reaction others got when they interrupted the boss at a meeting, took too long to return a customer's call, or missed a report deadline? When she complained bitterly about being barked at in front of everyone for these transgressions, they all wrote her off as "either an idiot or stoned."

✓ *You have little foresight.* If you can't hold past images in mind long enough—or hold enough of them—to see patterns developing, you won't be able to predict what's likely to happen next and get ready for it.

Mike had gotten enough tickets to have the image of a flashing red light approaching his car from behind emblazoned on his brain. Yet when he impulsively drove 30 miles per hour over the speed limit to get to his night class on time, he couldn't predict that he'd get stopped again—but he did.

✓ *Self-awareness comes slowly to you.* If you can't monitor how you're doing, whether in a routine task or a social situation, it's not easy to see where you are in relation to your long-term goals. You may not get the mental signals that it's time to chart a new course when that old one is not taking you where you want to go.

Sonya really wanted a lasting relationship. But whenever she was at a party, she'd drink too much, get too personal with strangers, talk incessantly so that no one got a word in edgewise, and make cracks about other women's outfits. Any guy she met who was interested at first drifted off quickly. When Sonya got home at the end of the evening, she invariably looked at herself in the mirror, pronounced herself "hot," and then brooded about why all the guys were such "losers."

✓ *Without a strong sense of the future, you'll opt for the quick reward, sacrificing gradual accumulation of assets.* You'll be like the grasshopper who whiles away the summer singing while the ant stores food for the winter, or the first little pig who quickly built a house of mere straw while his more self-controlled sibling took longer but built his house more substantially of brick. When the winter arrives or the wolf is at the door, the quick shortcut is never as good as the effort to pay attention to the longer term.

Tim and Marie were on the verge of divorce. Tim claimed he wanted to buy a house as much as his wife did, but every time they went on vacation, he'd listen to some time-share pitch and end up signing a contract for a week at yet another resort that Marie didn't necessarily want to return to. At the rate they were going, the couple wouldn't be able to buy a house until they were 70, unable to save for a down payment after these "investments."

✓ *You may not make a good team player . . . or know how to be a good friend.* When the grasshopper was starving, the ant rebuked him for failing to think ahead and create a nutritional stockpile. Social insurance can save your life. But if you have no concept of the future, sharing what you have with others makes no sense. All you can appreciate at the moment is the loss of your own hard-earned assets. You can see where this is going for adults with ADHD: You may have little capacity for or interest in sharing, cooperation, turn taking, and repaying the favors of others or fulfilling the promises you've made to them. They may very well respond to your requests for help as the ant did to the grasshopper.

LaTonya didn't understand why so many of her friends didn't return her phone calls. Her friends complained to each other that she was awfully quick to bum a ride or ask for another favor or even money but never hesitated to say no when one of them needed help from her. She owed every one of them a small amount of money but consistently claimed she couldn't afford it when a friend was short of cash and asked if LaTonya could pick up the tab for a fast-food burger. Many of them eventually became ex-friends.

Which of the preceding difficulties are big ones for you?

_____

_____

_____

_____

Verbal Working Memory: Using the Mind's Voice

The next or fourth executive function to develop in children that facilitates self-control is the ability to talk to yourself, especially in your mind. As kids we do this publicly. We narrate our play, talk to ourselves when alone, and weigh our decisions out loud. As every parent knows, kids can be pretty free with their commentary, even though their remarks may not be too flattering. Gradually children begin to talk to themselves silently, though they may still move their lips. By ages 7–9 they suppress even those movements, and now this voice occurs entirely in their mind. From this point on, the voice in our head will accompany us through all our waking hours until we die.

How Verbal Working Memory Guides Us

I also refer to this as the mind's voice. The capacity to converse with yourself, especially mentally, in concert with the capacity to sense to yourself brings about another form of self-regulation and with it a number of important features for self-control:

1. **It allows us to describe and contemplate an event or situation.** Let's say you come home from work and say hello to your roommate, and he doesn't answer. Nonverbal working memory might tell you that the look on his face indicates he's not happy. With verbal working memory, you might put words to the way he could be feeling: "He's angry." But that's still a global and vague sense of the situation. You might then use your mind's voice to look for more information by asking yourself specific questions, such as "Is he angry at me, at his girlfriend, his boss, or someone else?" Describing the situation to yourself and even interrogating yourself with such questions gets you much more specific information than just a mental image might achieve and could head you away from a hasty "What's wrong with you?" and toward a more nuanced and socially sensitive reply. You might say

to yourself, "He's not glaring at me. He's just stomping around the room looking mad. Last time it turned out he was just ticked off that he had missed a short putt while golfing that morning or had to work that weekend."

2. It makes problem solving possible. With private speech we can interrogate ourselves about our past to figure out how to solve a current dilemma. In trying to figure out how best to respond to your aggravated roommate, you might ask yourself, "What happened last time I assumed he was mad at me?" This introspection might reveal that you picked a fight, which your roommate was all too happy to engage in so he could take out his ire on someone. Your conclusion might then be that you need to find a way to ask him what's wrong without being either defensive or offensive.

3. We can formulate rules and plans. We need verbal working memory (our mind's voice) to examine how things went in the past and extract from that rules for making sure they go well in the future. Our self-questioning and other self-talk allow us to weigh pros and cons based on our past experience, to talk to ourselves about what we could change to improve the future, and to set out steps toward a goal. Our rules might involve diet and other lifestyle matters, social conduct, spending or saving habits, and more. Often, we make our self-statements and rules external and easier to follow by writing them down on a to-do list to help us remember and use later.

Eventually we go further and generate a hierarchy of rules about rules (called *meta-rules*). An example of a meta-rule in government might be the procedure required for enacting new legislation. In a school, it might be that the criteria for expelling a student must be approved by the school board. An example from daily life is the six well-known steps to solving a problem: (a) state the problem specifically, (b) list as many solutions as you can, (c) critique each one for its utility, (d) select the one most likely to achieve your goal, (e) implement it, and (f) evaluate its success. They are simply rules used to discover other, more specific rules that apply in a specific situation.

4. We can follow rules we're given. Using nonverbal and verbal working memory together, we call up mental pictures of similar situations from the past and then ask ourselves whether a rule we've learned applies here. If we don't really want to follow the rule anyway, we might use self-talk to either persuade ourselves to obey or convince ourselves that this is one of those exceptions that make the rule. Our self-speech complements our visual imagery by allowing us to get much more information out of our thinking than an image alone can convey.

5. We can hold in mind what we have silently read to ourselves or heard others say. In school it was called *reading and listening comprehension.* In the adult world it's necessary in most of what we do. We need to understand and remember

what we've read in reports and heard others summarize at work. We need to grasp the rules and procedures at our kids' school so that we don't put the kids at a disadvantage. If a bill goes unpaid, we need to comprehend the consequences explained in the statement and what action we must take to avoid the financial and legal fallout.

6. **We're capable of moral reasoning.** The rules—laws, ethics, customs—of the culture we live in play an important role in guiding our behavior. If we don't know what they are and can't talk to ourselves to remember what they are and how to apply them when we most need them, we can end up on the fringes of society, if not ousted altogether.

How ADHD Interferes with Verbal Working Memory

Is verbal working memory the type of self-control that eludes you most?

✓ *You talk out loud too much, especially when interacting with others, and often get off on irrelevant tangents:* Verbal working memory is based on our capacity to talk to ourselves using our inner or mind's voice. We can simulate what we will say, practice it, and then edit or change it as needed so that when we do say things to others those things are more tactful and hence more likely to promote the relationship and our own welfare. ADHD delays this ability to think and talk to ourselves privately in order to consider what we are about to say to others. So a lot of verbal thinking is done out loud, publicly, and is often inappropriate for that context. This can cause you to ramble on and on while freely associating to whatever thoughts come into your mind, to interrupt, and to verbally intrude on others' interactions. All of these behaviors can be interpreted as rudeness and lack of consideration for the feelings and intentions of others. And because of the reduced capacity for self-awareness and monitoring that is also inherent in adult ADHD, you may not even be aware of how you're coming across.

✓ *You don't use self-talk to control yourself or solve problems.* Without the benefit of self-talk, you shoot from the hip all the time. You might make a lot of false assumptions about people's intentions because you don't examine your first impression. You might literally attack any problem rather than thinking it through.

You might go through roommate after roommate and end up living alone.

✓ *You let events and the environment rule.* If you can't use self-speech to formulate your own rules and plans, you're always at the mercy of the moment. You're also vulnerable to the influence of others, whose advice and directives substitute for your own self-determined rules of behavior.

Hien was a "good kid" according to his teachers and his parents. But as he became independent, he seemed increasingly subject to bad influences. There was always someone at the local tavern who would convince Hien that he could buy another round. There was always a whim that would carry Hien into some ill-advised decision even though later he agreed with his parents that he should have known better.

✓ *You have trouble setting your own standards and making your own plans.* Without visual imagery and the ability to question your own past behavior, you won't extrapolate a list of dos and don'ts for future use.

Nina struggles with her weight, but she can't seem to resist a tempting dessert or snack when she sees it, so she keeps eating a diet that adds pounds to her frame. Without verbal working memory along with nonverbal working memory, Nina can't connect her impulsive eating habits with her weight gain or stick to a diet.

Carmelita is tired of being broke, but when she has paycheck in hand, she can't seem to stop shopping. If she could reflect on the consequences of those actions, she might be able to talk herself into going to the bank first and depositing a portion of her check in her savings account or even having her employer do this automatically.

Both women have occasionally tried to make rules to help themselves. Nina decided to severely limit her consumption of fat and sugar. Carmelita decided to put $100 from each paycheck into her savings account. The problem was that neither of them could make adjustments when their plans didn't work out. Nina's diet made her feel so deprived that she "cheated" constantly and never lost weight. With verbal working memory to aid her, she could have eventually created a meta-rule that before she went on any diet, she would go see her physician and get advice on a sensible weight-loss routine and then remove the most fattening substances from her home so they were simply not available and she wasn't forced to show self-restraint around them. Carmelita found that her savings account was growing way too slowly. With verbal and nonverbal working memory, she could have decided that she would review her spending/saving plan every month to see where she could save more and spend less and also have her employer deposit her paycheck automatically, even setting aside a portion in her retirement plan that the employer would match.

✓ *You follow certain rules rigidly.* A rule is not doing its job unless it can bend a little. The world does not operate on absolutes. But if you can't talk to yourself about the pros and cons and review with yourself the particulars of the situation that you're in, you might follow a rule so rigidly that it will backfire. People with ADHD often lack flexibility.

Max heard that certain fish contain toxic levels of mercury, so he's decided he won't eat any fish no matter what type or what its source. He looks foolish to friends and has offended people who have invited him over or taken him out for dinner, and he gets indignant and nasty when questioned.

Kaye has a set of workplace rules that she follows religiously because she doesn't trust her instincts. For each type of task, she follows the rules that she has developed on her own or been given outright by her supervisors to be sure she doesn't go off course. Following these rules prevents anxiety from consuming her at work . . . as long as the rules never change. It takes her a long time to adjust when new rules enter the mix or replace old ones.

✓ *. . . Or you don't follow them at all.*

Miguel knew that if he got one more speeding ticket, he'd lose his license. The only way he could muffle his instinct to floor it was to try calling up images of his previous tickets, picture what it would be like to be barred from driving, and continuously talk himself into staying below the speed limit. He didn't do that, and now he has to get up 2 hours earlier to take the bus to work.

✓ *You might commit crimes and violate ethical and moral codes.* Many of society's rules and customs are unspoken. Without verbal and nonverbal working memory to help you discern them, you can go through life without a clue, breaking customs and offending your fellow citizens left and right. Laws are written down, but without the mind's voice to remind you of them, you might easily yield to impulse and do whatever you want. And end up behind bars.

Sasha knew it was against the law to steal a car, but that the "joy ride" she and her friends took in the neighbor's unlocked sports car was a felony never entered her mind at the time. All she thought of at the time was that he wouldn't miss it for an hour or two.

✓ *You don't comprehend what you're exposed to as easily as others—whether it's what you read, see, or hear.* The give and take between verbal and nonverbal working memory is what makes it possible for us to make sense of all the input we receive from the world around us. Without that, we miss out on many, many mental connections.

Of course Eric could read. But there were holes in what he took from his reading. His own work was pronounced "sloppy" by his boss because he could quote statistics from various reports but often got things backwards when he drew conclusions from the data. He sent his son to school on a field trip day without the permission slip, the bag lunch, or the swimsuit required; his son had to stay at school with a

younger class. The family's electricity had been turned off twice because Eric forgot to pay the bill and then didn't notice the deadline for disconnection or the hefty reconnection fee.

What types of verbal working memory problems interfere with *your* life?

_____

_____

_____

_____

Self-Regulation of Emotion and Self-Motivation: Using the Mind's Heart

The fifth executive function that develops is the self-regulation of emotion. Emotions are primitive yet powerful signals we give off to ourselves and others as to our current feelings, intentions, and state of arousal. But they are also strong motivators of our subsequent actions. They can arouse us to act or prevent us from acting. They can tell us to fight or send us into flight. They can signal within and outside of us our impatience and anger, or joy and affection. If we have no control over our emotions, we have a lot less control over what we do. Emotions arise whether we want them to or not. They are triggered naturally by external events of all kinds. Sadness is triggered by loss (or anticipating loss). Anger is triggered by unfairness, humiliation, unmet expectations, or unanswered needs. Joy is triggered when our expectations and needs are not only met but exceeded and when our desires are fulfilled.

But it's not just external events that bring on emotions. The resensed experiences and self-talk made possible by nonverbal and verbal working memory also have emotional overtones. Picturing your spouse might bring on a feeling of love; talking to yourself about some injustice you recently suffered can make you feel rage.

Fortunately, nonverbal and verbal working memory are also instrumental in helping us regulate our emotional response. We can use self-talk to deliberate with ourselves about how we feel and what we should do about it. We can use our visual imagery and self-speech to try to alter an initial emotional reaction that might cause problems for us, especially if that initial response pushes us into regrettable behavior.

Many adults with ADHD say they would be sunk without self-talk. They also find using visual imagery very beneficial but say it requires practice, practice, and more practice. What's been your experience?

_____

_____

_____

_____

How Self-Regulation of Emotion Guides Us

1. We can control our own arousal. By *arousal* I mean the urge and energy to act, or activation. Emotions are intended to spur us into action. But what if those emotions are exaggerated? Or they are based on a misperception of the situation? In those cases we're obviously going to overreact or go off half-cocked in some way. Controlling our initial emotional reactions to events can prevent us from doing something rash. Or it can drive us to act when we may be suffering from inertia or just plain boredom with what we need to get done. With emotional self-regulation possible, we now have three executive functions that can interact, each supporting the other. Holding on to the images of the past and our visions for the future and being able to talk ourselves down can ensure that emotion doesn't derail our plans and supports our actions toward a better future, even in the absence of immediate rewards. Being able to dampen emotional arousal means we won't start "talking crazy" to ourselves and change course without serious consideration. Being able to visualize our goals and how we will feel when we get there can sustain us through the most boring or unrewarding of immediate activities necessary to get there.

2. We can motivate ourselves when we don't have external rewards to push us. Call it drive, willpower, persistence, determination, stick-to-itiveness—what have you. I call it the mind's fuel tank because it generates the internal "fuel" or drive that powers us toward our goals. While I and many other neuropsychologists think of this as a separate executive function (the sixth here in my list), I combine it with emotional self-control because that is what helps to create our self-motivation. The former is therefore indispensable to the latter. By regulating and even creating our emotions with the other executive functions discussed

above, we endow ourselves with internal motivation when no one else is handing us any incentive from the outside. Again, it's the four earlier executive functions working *in concert* that allow us to both self-regulate our emotions and then motivate ourselves to keep going when the going gets tough (or boring). Let's say you want to volunteer with an organization devoted to protecting the environment. You make phone call after phone call asking people to support a major recycling effort. Before long you're extremely dejected at all the rejections you get. In that case you use two of the executive functions you already have (visual imagery, self-talk) to remind you of your successes so far, keep your eye on the ultimate goal, and push you to keep making those calls. If envisioning your success and the potential for reaching the goal isn't enough to get you to pick up that phone again, maybe you intentionally conjure up images of the destruction of the planet and use the anger these images stimulate to motivate you onward.

3. We can make sure we express emotion in socially acceptable ways. This is a biggie. Because we expect adults to have this executive function, society reacts pretty negatively to extreme or exaggerated expressions of emotion. We accept the fact that babies scream at the slightest emotional pain because it's a self-preservation mechanism. And we understand perfectly when 3-year-olds throw a temper tantrum when they don't get the candy at the grocery store checkout counter. But we're embarrassed and disapproving of an adult who bursts into tears or yells in anger in public over a minor frustration like having to stand in a long line at the supermarket.

4. We have a sense of mastery over ourselves and especially our emotional reactions to events. When we develop our capacity to regulate our emotions in the service of our goals and longer-term welfare, we gain a sense of command or mastery of our impulsive reactions to events around us. No longer a slave to our passions, we, and not any potentially provocative events, are in charge of what we will decide to do in response to what is happening to us. We don't go off like a string of firecrackers in reaction to the sequence of events around us because we have self-discipline. We aren't entirely controlled by the flow of events going on around us but instead can exert control over our feelings and reactions as well as over the events themselves. We take charge of our lives instead of life taking charge of us. This makes us less mercurial, unpredictable, or capricious in our responses to events and to others and more measured, stable, and mature, with a new sense of freedom in our interactions.

There's a reason we use the expressions "emotional turmoil" and "emotionally charged" to capture the loss of control one can have when emotionally powerful events trigger strong feelings in us and the internal disarray we can feel when

we cannot master those strong reactions to events. Emotion is so powerful that it's as if it has an electric charge that is transferred to those around us. We're expected to keep it under control so as not to impose our feelings on other people. If we are able to regulate our own emotions, when we are angry, we can "go to our happy place" by using images of positive past experiences and talking ourselves into calming down before we finally react to some emotion-laden event. Responding impulsively to our first emotional reactions to events is rarely a good idea if we want to make or keep friends or intimate partners, much less a job.

Do you use images of positive past experiences to "talk yourself down" when angry, anxious, or stressed? Accomplishments that you're proud of—whether it's climbing a mountain, finishing a detail-filled report, or getting along with everyone at a family wedding—leave you feeling both calm and motivated and are great candidates for visual imagery. What are yours?

To put it more plainly, this executive function lets us:

- ✓ Soothe ourselves when we are having extreme emotional reactions to an event
- ✓ Use our own mental images and words to distract ourselves from the powerful stimulus that has set off our strong emotional feelings
- ✓ Consider and implement an alternative emotion by calling up images and words associated with more positive emotions and relaxation
- ✓ Choose a more moderate emotional tone or reaction that is supportive of rather than detrimental to our own longer-term goals and welfare

This is what emotional self-control is all about: helping us stop and moderate those powerful knee-jerk emotions and substitute others that are more mature, socially acceptable, and consistent with our longer-term welfare.

How ADHD Interferes with Self-Regulation of Emotion

Is it *emotional* self-control that eludes you most?

✓ *Your emotional reactions to events are as impulsive as the rest of your behavior and can make you an outcast.* Without the ability to put on the brakes, you don't have time to alter your initial emotional reactions. Without well-developed verbal and nonverbal working memory, you have less capacity for the visual imagery and self-speech that can help you calm your emotions.

> *The first characteristic Jay's friends use to describe him is "hot-headed." They've all witnessed embarrassing displays of sudden anger from Jay at the slightest provocation, whether it's a pizza delivered with the wrong toppings or a stranger giving him "a look" (that no one else can even see). His emotional hair trigger has cost him social invitations, the trust of coworkers, and a lot of friendships.*

✓ *Emotional reactions that are disproportionate to the event often steer you wrong.* I'm not talking about abnormal, irrational, or grossly inappropriate reactions. But exaggerated emotion that's not in keeping with the situation—laughing loudly at a mild pun made quietly at a funeral, sobbing after a minor snub—can lead to social rejection. Disproportionate emotional reactions can also throw you off course. Feeling extremely angry about a minor failure at work could cause you to leave a job ideally suited to your career goals. Plunging into despair can paralyze you when you really need to keep moving. Becoming elated by modest success can convince you that you've reached your peak, and you might stop trying to achieve a goal that you really value.

> *Vanessa was so ecstatic about her first-ever sales award that she skipped into her boss's office and announced that she was going to start her own sales company and hoped the boss would consider hiring out the company's sales work to her new firm. Her initial excitement is understandable, but her unmoderated display of it to her boss borders on the grandiose.*

✓ *You find it tough to rouse yourself to do what you need to do.* Emotion is definitely a double-edged sword. You want to keep exaggerated and impulsive emotion under control. But you also want to be able to call emotion into play to kick yourself into gear to get things done. You're more subject than other adults to frustration, boredom, and resentment. These tendencies already make it hard to stick with tasks. Add in the difficulties you suffer with attention and concentration and it's even harder to see a task through. Here's where emotion can serve you well. If you can regulate your own emotions, you can use them to kick-start yourself to do

work or to maintain your general arousal level so you can stay awake, alert, and focused when you have goals to pursue.

Does emotion run away with you more in some situations than in others? Which ones?

_____

_____

_____

_____

These are the situations where you'll have to resolve to pull out your whole bag of self-talk and visual imagery tricks to stay in control.

Planning and Problem Solving: Using the Mind's Playground

If we can hold images and words in mind, we eventually develop a means to manipulate them. We can take them apart, move them about, and recombine them into new arrangements or sequences in our heads just for the sake of seeing what the results are likely to be. It is our imagination. And it is no surprise that humans do this more than any other species. This is fundamentally a form of mental play, and it originates, I believe, in the extended period of manual, physical play that all children go through as an important stage of early development. Play is simply taking things apart and recombining them just to see what happens or what you wind up with when you do so. It begins with manual manipulation of objects in childhood and progresses to the manipulation of images and even words in your mind. Mind wandering, fantasy, and mental play are the wellspring of human creativity, ingenuity, and problem solving more generally. Where others species can only act and thus suffer from any mistakes they make, humans can mentally simulate a variety of possible options for actions, testing each out in their mind for their likely consequences and ideally choosing the optimal. Where other species may be harmed or even die from their mistakes, we let our simulated ideas die in our place.

Similarly, we play with words as children and then play with combinations of words in our minds as adults. Both of these forms of play, visual–spatial and verbal, lead to novel recombinations of the material we're playing with. Most of those

recombinations are junk. (Think of some of the "crazy" ideas we all come up with and then discard when trying to get out of a tough dilemma: "Maybe this cop won't give me a ticket if I tell him I was speeding because my wife is in the hospital about to have a baby" . . . "If I stay up all night tonight *and* tomorrow, that should give me enough hours to write that report that's already overdue" . . . "I could just stand up *both* of the women I made a date with for Saturday, and then neither one of them would think I preferred to go out with someone else!") But some are new ideas or ways to solve problems that lead to new (and even great) inventions or innovations.

Play is training for inventiveness in adult problem solving.

How the Ability to Plan and Problem-Solve Guides Us

1. It helps us consider all the options. Planning entails the ability to generate multiple options for responding to a future event. When we make ourselves aware of all the possible ways to respond, we're much more likely to identify and then pick the best one. Think of brainstorming. This executive function is the best way to prevent the after-the-fact regret of "Why didn't I think of that?"

2. It helps us decide on the best sequence of actions to reach a goal. In the form of mental play that we call planning, we take apart and recombine information in our mind. Once we've got a comprehensive list of options, we can look at the steps each one might involve and then shuffle those steps around to see what sequence will be best. We can, in a real sense, mentally simulate these various sequences to see how they might actually play out before selecting the one that best meets our objectives.

3. The capacity to mentally manipulate information and play with it in our minds gives us an incredible capacity for goal-directed creativity and innovation. Thinking outside the box just can't happen without the mental play that this executive function makes possible. It's like free will (see Chapter 8) cubed. Not only do *you* decide what to do, but you do it in a way that might not have occurred to anyone else. Creativity and innovation may mean a faster route to where we want to go, less effort, or just a better result.

Ironically, the planning that you may find painfully slow can help you get a project done far faster.

How ADHD Interferes with Planning and Problem Solving

Are your problems with self-control connected to an inability to plan and problem-solve?

✓ *You can't think on your feet.* Yes, I know: People usually view your tendency to react fast as a negative. But thinking on your feet means choosing a wise course of action quickly when the need arises suddenly, as it so often does in daily life. Not only is it tough for you to hold lots of information in mind (because of deficits in working memory), but without the planning/problem-solving executive function you can't manipulate the information quickly to plan out possible courses of action or to problem-solve your way around obstacles. This doesn't mean you don't decide quickly—you do! That's the problem—you don't deliberate over all the possible options available before making that snap decision.

James desperately wanted to be a firefighter. But when the preliminary training began, it was immediately clear that he couldn't make the quick decisions necessary to save a building or its inhabitants.

✓ *You can't get or stay organized.* Even when circumstances don't call for a snap decision, you're going to have trouble keeping materials and data organized. This goes for everything from the documentation for your tax return to your files at work or your diabetic child's medical records. If you can't do the mental play, it's hard to envision the game board when you need to make your moves.

Every couple of years Marta decided to redo her family's personal financial files because she could "never find anything." She would yank everything out of the file drawers and start trying to come up with her own system. But invariably she quickly got lost in all the paper, and her husband, Guillaume, would come home to find files and documents scattered everywhere.

✓ *Putting ideas in the correct order is a big challenge for you.* Keep in mind that when you take something apart, you have to put it back together in a certain order for it to operate correctly or make sense. Ideas need to be assembled in their correct order so that they function as intended to solve a problem or make sense. Reasoning, problem solving, planning, explaining, writing, and otherwise conveying your ideas rapidly and in a logical sequence are all going to be tough tasks for you.

Writing and giving instructional presentations was almost impossible for Luis. This deficit was really holding him back in his career until his boss realized at one seminar how positively the participants responded to Luis personally. Thanks to an insightful supervisor, the seminar presentations were recast so that a coworker went over the instructional steps and Luis provided the anecdotes and inspirational material. The seminars were more successful than ever.

Planning and problem-solving skills are central to many adult endeavors. Deficits in these areas can make you feel inadequate if you don't remind yourself that it's not your intelligence level that's the problem; it's the interference of ADHD. What feelings of inadequacy can you now see as the unfortunate fallout of ADHD?

_____

_____

_____

_____

The Seven Executive Functions That Foster Self-Control

The mind's mirror (self-awareness)

The mind's brakes (inhibition)

The mind's eye (nonverbal working memory)

The mind's voice (verbal working memory)

The mind's heart (emotional self-control)

The mind's fuel tank (self-motivation)

The mind's playground (planning and problem-solving)

Guilford Publications
370 Seventh Avenue
New York, NY 10001
212-431-9800
800-365-7006
www.guilford.com