ADHD and Executive Functioning

by Russell A. Barkley, PhD

WE often hear that ADHD is a disorder of executive functioning (EF) and that it also involves poor self-regulation. But what do these terms mean? And how are they related? What do they have to do with ADHD? And with its management? A lot, as I will explain here.

ADHD involves significant problems with sustained attention, persistence toward goals, resisting distractions along the way, inhibiting excessive task-irrelevant activity (hyperactivity), and inhibiting actions, words, thoughts, and emotions that are either socially inappropriate for the situation or inconsistent with one's longer term goals and general welfare.

Since the late 1970s, clinical researchers who were studying ADHD asserted that the disorder likely involved a serious problem with self-regulation. Why? Because they had already begun documenting through various measures that ADHD was associated with deficits in inhibition, managing one's attention, self-talk and rule-following, self-motivation, and eventually even self-awareness. If ADHD involved difficulties in these faculties and these are the human mental abilities that are involved in our being able to control our own behavior, then logically ADHD ought to be a disorder of self-regulation.

Since then, research has continued to affirm the involvement of deficits in these and other mental abilities that are essential for our effective self-regulation. ADHD is actually SRDD (self-regulation deficit disorder). While the official name for the disorder will not be changed anytime soon in the official manual that grants names to mental disorders (*Diagnostic and Statistical Manual for Mental Disorders, 5th Edition,* or DSM-5), it is still important that people understand this connection between ADHD and self-regulation deficits.

Conflict between the "now" and the "later"

The incredible value in viewing ADHD as SRDD comes from also understanding that our brain-based executive functions are what allow us to engage in self-control. Let's see just how that works by starting with the definition of self-control. The term is often considered to involve at least three components: (1) any action an individual directs at themselves so as to (2) result in a change in their behavior (from what they might otherwise have done) in order to (3) change the likelihood of a future consequence or attainment of a goal. In short, it is self-adjusting your own current behavior to make it more or less likely that you will be better off in the future.

When you walk into a coffee shop intending only to buy coffee and you see a display counter filled with pastries or confections, you face a situation that may tempt you to buy things now that are likely to ruin your plans for losing weight this month. This exposes the heart of situations that test our self-regulation—they pose a conflict between the "now" and the "later," or more accurately "me now" and "me later." To deal with this conflict and the immediate temptation you face while you wait for your coffee to be prepared, you may avert your eyes from the counter, walk to a different section of the shop away from the tempting goodies, engage yourself in mental conversation about why you need to not buy those products, and even visualize yourself saying no to

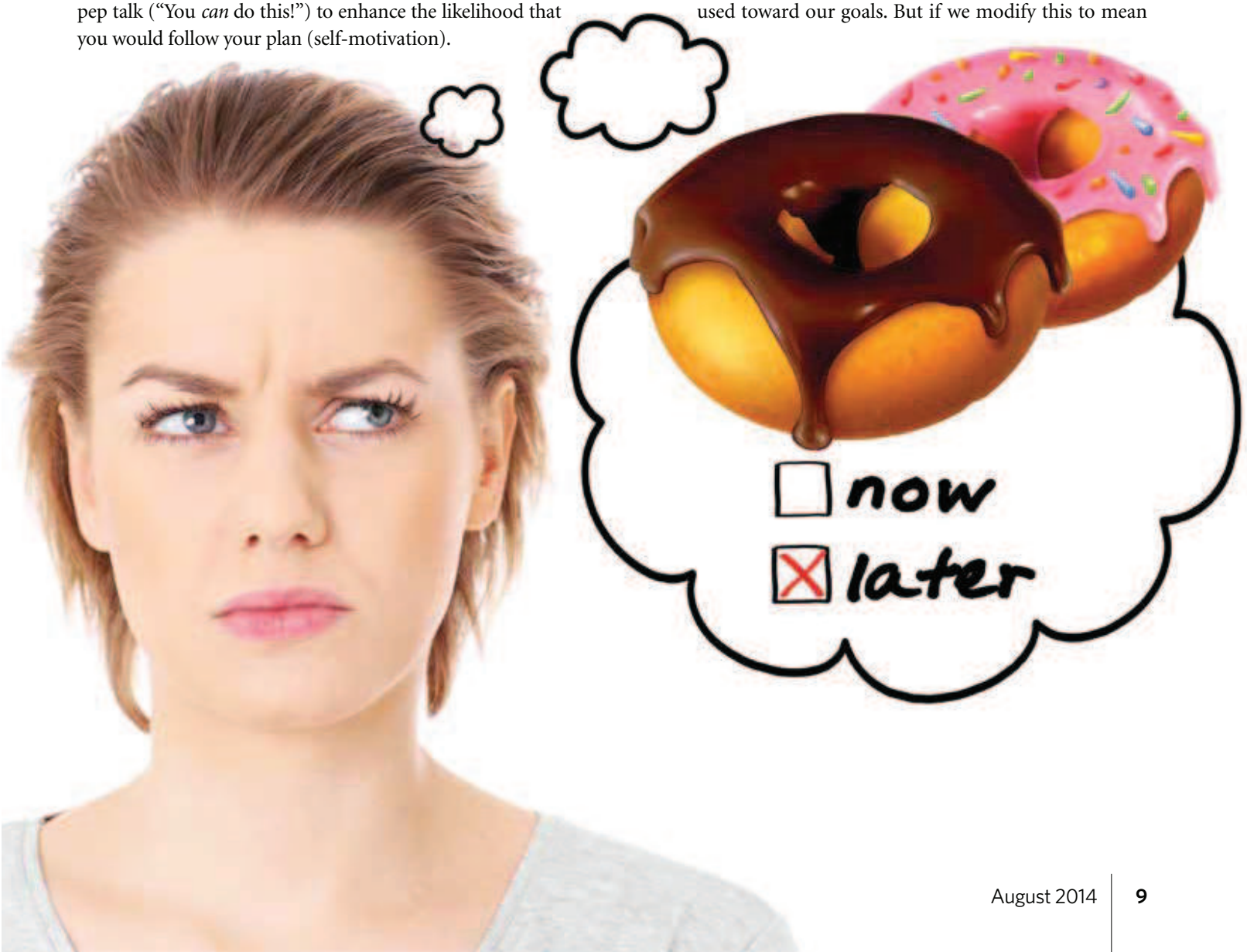
the clerk who asks you if you want a doughnut with that coffee. You may even call up an image of the new, more slender version of yourself you expect to achieve in the near future to help motivate you to say no to that doughnut. All of these are self-directed actions you are using to try and alter the likelihood of giving into temptation and therefore increase your chances of meeting your goal of weight loss this month.

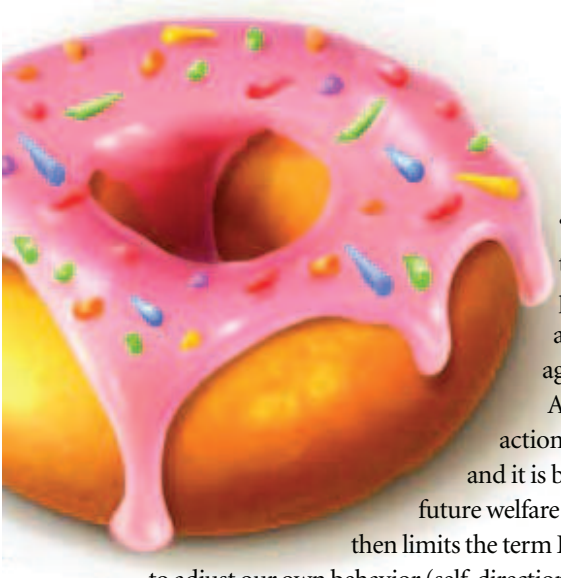
This situation calls upon a number of distinct yet interacting mental abilities to successfully negotiate the situation. You have to be aware that a conflict has arisen when you walked into the shop (self-awareness), you have to restrain your urge to order the pastry to go with the coffee you have ordered (inhibition), you redirected your attention away from the tempting doughnuts (executive attention or attentional management), you spoke to yourself using your mind's voice (verbal self-talk or working memory), and you visualized an image of your planned behavior (saying no) and your eventual goal of what you would look like when you successfully attain it (nonverbal working memory, or visual imagery). You may also have found yourself thinking about various other ways you could have coped effectively with these temptations (problem-solving), and may have given yourself a pep talk ("You *can* do this!") to enhance the likelihood that you would follow your plan (self-motivation).

Okay, so that is the nature of our self-regulation. How does EF link up with SR? Simply, EF involves those things you just did to try and manage yourself. You monitored yourself, recalled your goals, inhibited yourself, visualized your plans and goals, talked to yourself, and attempted to self-motivate, among other things. In my theory of EF, each of these is a component of EF and each is a type of self-control—something we did to readjust our own behavior to make a future goal more likely to occur. An EF is a type of SR, in my view. People use various types of actions they direct at themselves to manage themselves for a better future. They use at least six different types of self-directed actions (EFs) that form a Swiss Army knife of mind tools for self-control.

Defining executive functioning

While this is my view, I must confess that there is no consensus in neuropsychology at this time on the meaning of the term EF, despite its being used prolifically in journal articles, presentations, and books, including those about ADHD. A commonly used definition is that EF means "those neuropsychological processes needed to sustain problem-solving toward a goal." I think this is close, but too vague, as just about any and all mental abilities are used toward our goals. But if we modify this to mean





"those self-directed actions needed to sustain problem-solving toward a goal," then this nicely agrees with my view.

An EF is a self-directed action (a form of self-control), and it is being used to improve our future welfare (accomplish a goal). This then limits the term EF to those actions we use to adjust our own behavior (self-direction). I think there are at least six such actions: inhibition and resistance to distraction (self-restraint), self-awareness (self-directed attention), working memory (self-talk and visual imagery, or seeing to ourselves), planning and problem-solving (self-directed play), emotional self-control (self-directed emotion), and even self-motivation. As these self-directed actions develop in childhood, they may be visible to others (talking to ourselves, for instance), but as we mature the publicly observable features become inhibited or privatized and they eventually are internalized, mental, and largely not visible to others.

In my theory of ADHD, those with it have great difficulties with using their EFs (self-directed actions) for purposes of self-regulation and attaining their goals because they are delayed in the development or have experienced injury to those brain networks that create the EFs and self-regulation. We can now understand that ADHD involves more than just the obvious symptoms of inattention/distractibility and impulsivity/hyperactivity, as listed in the DSM-5. ADHD therefore involves deficits in self-restraint, self-awareness, self-speech, self-sensing and imagery, self-control of emotion, self-motivation, and self-directed play for planning and problem solving. These difficulties are delays or deficiencies in the development of these important mental abilities, and not absolute losses of these abilities as might occur after a severe brain injury.

Therefore, what distinguishes someone with ADHD from someone without it is that they appear to be less mature (are age-inappropriate) in their ability to engage in self-regulation (EF) toward specific goals and the future more generally. To help someone with ADHD, he or she must be helped to either correct these delays/deficits or at least compensate for them (make accommodations to them) if they are to be more effective or successful in managing themselves, getting to their tasks and goals, and preparing for their future more generally. We have no ways to permanently correct the neurological problems, but medications may do so to a large extent and temporarily while being taken. Mostly we have strategies to help people compensate for the EF deficits and so reduce the likelihood they may be impaired in their major life activities from those deficits.

Principles of treating ADHD

Disorders of EF or self-regulation, like ADHD, are not easily managed. That is because they create disorders mainly of performance rather than of knowledge or skills. They are problems with doing what one knows and not of knowing what to do. Mental health and education professionals are more expert at conveying knowledge (what to do)—how to change. They are not as informed about ways to help people do what they know; to engineer environments to facilitate performance, or the where and when to change. At the core of such problems of performance is the vexing issue of just how one gets people to behave in ways that they know may be good for them yet which they seem unlikely, unable, or unwilling to perform.

Conveying more knowledge does not prove as helpful as altering things in the setting associated with the performance of that behavior at its appropriate place and time. Yet we must accept the fact that such changes in behavior are likely to be maintained only so long as those environmental adjustments or accommodations are as well. To expect otherwise would seem to approach the treatment of EF deficits with outdated or misguided assumptions that one can cure these deficits with a short-term course of treatment. To date that has not been the case.

However, here are some very useful strategies or principles of treating ADHD that come out of this theory that ADHD is SRDD which is EFDD.

1. **If behavior is not being effectively controlled by internally represented information (ideas being held in mind; working memory), help that person by "externalizing" that information.** Find ways to physically represent that information in the problem setting at the point of performance (where and when this information should be used). For instance, using sticky notes, cards, signs, or other physical cues and reminders placed precisely in that situation and at that time when something is to be done can go a long way toward making up for the working memory deficits.
2. **ADHD creates time blindness.** Those with ADHD cannot organize their behavior both within and across time, leaving them with serious problems with time, timing, and timeliness of behavior, such that they are to time what nearsightedness is to vision. They create a temporal myopia in which the individual's behavior is governed more than normal by events close to or within the "now" and immediate context, rather than by internal information that pertains to longer term, future events. This helps us to understand why adults with EF deficits make the decisions they do, short-sighted as they seem to be to others around them.

   If one has little regard for future events, then much of one's behavior will be aimed at maximizing the moment and its immediate rewards and escaping from immediate hardships or aversive circumstances without concern for the delayed consequences of those actions. To help with this timing problem, time itself must be "externalized" or represented in situations where time is important. This can be done for short-term projects by

placing various timing devices in the situation where the work must be done. For longer-term projects, it can be addressed breaking these projects into many smaller parts that can be done frequently or daily making each "baby step" toward the goal far easier to do than when one is contemplating the entire project to be done across a long time span.

3. **Add more consequences and accountability to the problem situation.** ADHD creates a deficit in self-motivation. That is the very type of motivation that one needs to support or drive goal-directed behavior toward the goal. What to do? As above, "externalize" the motivation. Add more external and artificial immediate consequences to that situation where one must do work in the absence of immediate natural consequences.

   For instance, the provision of artificial rewards, such as tokens, may be needed throughout the performance of a task or other goal-directed behavior when there is otherwise little or no such immediate consequences associated with that performance. Such artificial reward programs become for the person with EF deficits what prosthetic devices such as mechanical limbs are to amputees. The artificial consequences allow them to perform more effectively in some tasks and settings with which they otherwise would have considerable difficulty. This can also be done by making the person more accountable to others and doing so more often across the work period (closer supervision, more frequent checking-in with the supervisor, more frequent unannounced spot-checks by the supervisor). The motivational disability created by the EF deficits makes such motivational "prostheses" nearly essential for most people with such deficits.

4. **Boost the EF fuel tank.** Engaging in EF and SR takes effort and that effort or "fuel" tank has a limited capacity. Having ADHD probably leads to more such effort being expended to do routine tasks than typical people have to expend and may even be associated with a smaller fuel tank of effort. The more EF one has to use the more effort must be expended to do the task, and thus the more one is depleting that tank or resource. This results in an individual being less capable of SR in immediately subsequent situations and thus more likely to experience failures in self-control in that next situation.

Such temporary depletion of the fuel tank may be further exacerbated by excess stress, excessive use of alcohol or other drugs, illness, or even low levels of blood glucose. Yet, research shows that doing certain things can help to replenish that fuel tank, such as:

- routine physical exercise
- taking ten-minute breaks periodically during situations that heavily tax self-control
- relaxing or meditating for at least three minutes after or occasionally during such exerting activities
- visualizing the rewards or outcomes while involved in EF/SR tasks
- arranging for periodic small rewards throughout the tasks or SR-demanding settings
- engaging in self-affirming statements of self-efficacy prior to and during such tasks
- experiencing positive emotions, and
- consuming (sipping) glucose-rich beverages (like sports drinks) during the task.

5. **Take your ADHD medication consistently, as prescribed.** To date, ADHD medications are the only treatments that can result in improvement or normalization of the underlying neurological and even genetic substrates of the EF deficits—even if this improvement is only temporary while the drug is acting in the body. This is no different than using insulin for diabetes. It does not permanently correct the underlying neurological problem but can temporarily do so or at least improve it while the drug is in the body. The ADHD stimulants or the nonstimulants like atomoxetine or guanfacine XR can improve or even temporarily normalize the neural substrates in the brain's prefrontal regions and related networks that likely underlie these deficits. For instance, research shows that clinical improvement in behavior occurs in as many as 75–92% of those with ADHD and results in a temporary normalization of behavior in approximately 50–60% of these cases, on average.

ADHD is a disorder of self-regulation. Self-regulation requires that a person have intact executive functions. The EFs are specific types of self-regulation or self-directed actions that people use to manage themselves effectively in order to sustain their actions (and problem-solving) toward their goals and the future. ADHD is both SRDD (self-regulation deficit disorder) and also EFDD. By understanding this relationship among these terms, we can understand that people with ADHD have difficulties using the mental forms of self-directed actions we all use to manage ourselves effectively so as to attain our goals and see to our long-term welfare. To deal with the problems ADHD creates, we will need to understand that it involves EF deficits and that such deficits can be temporarily improved or normalized with ADHD medications and also compensated for by modifying the environment and making other accommodations so as to both buttress and facilitate the individual's use of their own self-control.

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