CHAPTER 1

A Review of Research on SCT

This introductory chapter briefly reviews the evidence supporting the conclusion that a second attention disorder exists, known as "sluggish cognitive tempo" (SCT), which is distinct from, yet overlaps with, ADHD. The review is adapted from my earlier chapter on this topic (Barkley, 2015a) but updated with the numerous research studies and a meta-analysis that were published thereafter. The abbreviation "SCT" has been in use since the term was first coined in the 1980s, based on research studying dimensions of attention problems in children with ADHD. Along with other researchers, I believe the term "sluggish cognitive tempo" is far from ideal, and many are recommending it be changed to something less derogatory, pejorative, or, frankly, offensive. I have suggested that the name be changed to concentration deficit disorder (CDD) for this precise reason (Barkley, 2014; Saxbe & Barkley, 2014).

Some prior reviews have suggested that the condition be called "attention-deficit disorder" (ADD; Diamond, 2005). Many clinicians have adopted this term for people who are primarily inattentive and have little or no evidence of hyperactive or impulsive behavior. Although some of those cases likely involve SCT, I do not believe it is advisable to use the term "ADD" for this heterogeneous group. For one reason, ADD is the older term for ADHD, dating back to the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III; American Psychiatric Association, 1980). Resurrecting ADD as the name for a second attention disorder that is distinct in many ways from ADHD serves to create unnecessary confusion between the conditions. Moreover, ADD could be inferred to be a type or presentation of ADHD, such as is the primarily inattentive presentation now set forth in DSM-5 (American Psychiatric Association, 2013). As for continuing to use the term "SCT," the name clearly implies that the core cognitive deficit(s) underlying the condition has been definitively established (slow timing of thinking or information processing), which is not true. The same criticism can be applied to other terms

suggested for something similar to this condition, such as primary disorder of vigilance (PDV; Weinberg & Brumback, 1990, 1992; Weinberg & Harper, 1993).

CDD, I believe, seems to be a reasonable option as an alternative label for SCT for various reasons: (1) It has not been used for any other disorder previously; (2) it keeps the focus of the label on an attention problem yet makes it distinct from ADHD; (3) it is not offensive or pejorative to patients and family members, as is SCT; (4) it does not imply that we know more than we do about the underlying cognitive dysfunction, as do SCT and PDV; and (5) it suggests some overlap with ADHD, which is the case (see Barkley, 2014). Moreover, the term "concentration" does not appear in the symptom lists for either ADHD (DSM-5) or SCT (Penny, Waschbusch, Klein, Corkum, & Eskes, 2009) and thus is less likely to create unnecessary semantic confusion. Throughout the remainder of this chapter, I refer to this condition as SCT, because it is a review of the history and findings related to that condition, in contrast to what is seen in ADHD. I wish to remain true to the term as used by other researchers in discussing their own findings, at least for the time being, until the field can reach some consensus on a less derogatory term.

History of SCT versus ADHD

Cases of SCT have likely existed within the human population at least throughout the past two centuries, if not longer. Descriptions of individuals with "low power" of attention or arousal, who appear to stare or daydream frequently, and who otherwise seem inattentive or sluggish and erratic in accurately processing information seem to first appear in the literature in Crichton's medical textbook, wherein he provided us with a description of two disorders of attention (Crichton, 1798/1976; also see Palmer & Finger, 2001). One disorder clearly resembles what today we label as ADHD. In contrast to it, Crichton had little to say about the other disorder of attention, except that it may be associated with debility or torpor of the body that weakens attention, thus causing individuals to be retiring, unsocial, and to have few friends or attachments of any kind. SCT may also have been the subject of a nursery rhyme written by the German psychiatrist Heinrich Hoffman, entitled "Johnny Head-in-the-Air," which was contained in his illustrated children's storybook, *Der Struwwelpeter*, published in 1865. The book is often cited as an early reference to ADHD, as represented in "The Story of Fidgety Philip."

Apart from such historical curiosities, the contemporary period of research on SCT began in the 1980s and was clearly a consequence of the creation of two types of ADD in DSM-III (American Psychiatric Association, 1980): ADD with (+H) and without (–H) hyperactivity. Studies soon began to appear that examined differences between children having each type of ADD (Carlson, 1986; Lahey, Schaughency, Strauss, & Frame, 1984; Maurer & Stewart, 1980; Milich, Ballentine, & Lynam, 2001). Their findings met with mixed success in differentiating the two types on features other than what would have been evident from their symptom requirements. That led to the removal of this subtyping approach in the subsequent DSM-III-R (American Psychiatric Association, 1987), only to see it return in the subtyping framework contained in DSM-IV as ADHD, combined type, versus ADHD, predominantly inattentive type (American Psychiatric Association, 1994). This subtyping

method was demoted again to the status of a mere "presentation" in the most recent DSM (DSM-5; American Psychiatric Association, 2013).

The specific identification of SCT seems to have begun in 1984 when Lahey and colleagues (1984) compared just 10 children with ADD+H to 20 children with ADD–H. They reported that the ADD+H group had significantly higher levels of aggressive behavior and conduct problems, bizarre behavior, lack of guilt, peer unpopularity, and poor performance in school. In comparison, the ADD–H children were more likely to be anxious, shy, socially withdrawn, and moderately unpopular, as well as poor in sports and impaired in school performance, all of which would later be replicated as correlates of SCT. The authors identified a set of symptoms in the ADD–H group that seemed to best characterize their attention problems but that were not part of the DSM symptom lists. Those symptoms included drowsiness, sluggishness, and daydreaming, among others (Carlson, personal communication, November 20, 2013). In 1985, according to Carlson (1986), a student of Lahey's (Neeper) conducted a cluster analysis in order to subtype learning-disabled children on the basis of their behavior by using a rating scale that contained these and other items (see also Carlson, Lahey, & Neeper, 1986). He identified a separate group of 11 children having high scores on an inattention–disorganization factor and low scores in motor hyperactivity. That separate factor was then named a "sluggish tempo factor" and comprised items related to apathetic, lethargic, sluggish, and drowsy behaviors. The condition has been referred to as "sluggish cognitive tempo" ever since.

In 2001, a very influential review of the literature concerning the two attention disorders (ADD+H and ADD–H) was published by Milich and colleagues (2001). The authors comprehensively reviewed research regarding comparisons of the subtypes. They also reviewed research using factor analysis of ratings of inattention. That research identified three distinct factors, two of which characterized ADHD: inattention and hyperactive–impulsive symptoms. SCT symptoms formed a third and distinct factor from these other two dimensions, and so the label SCT was applied to it. This was also found to be the case in a factor analysis of the direct observation form of the Child Behavior Checklist by McConaughy and Achenbach (2001), in which a separate attention deficit emerged independent of that typifying ADHD. Also in 2001, McBurnett et al. conducted a factor analysis of ratings collected on 692 children referred to a specialty pediatric clinic for ADHD and found, as did Neeper earlier (dissertation research cited in Carlson et al., 1986), that symptoms labeled as SCT formed a distinct dimension from the two traditional ones comprising ADHD. Three years later, Todd and colleagues (Todd, Rasmussen, Wood, Levy, & Hay, 2004) factor-analyzed data from 2,894 twin pairs and also found a separate factor for SCT symptoms distinct from those for ADHD. Such a factor would emerge from all subsequent studies of the symptom lists of ADHD and SCT.

In the past decade, studies have focused specifically on children identified with high levels of SCT symptoms, in comparison to those with ADHD. Some studies have estimated that as many as 30–63% of cases of the predominantly inattentive cases of ADHD have high levels of SCT (Carlson & Mann, 2002; Garner et al., 2010; McBurnett et al., 2001). Subsequently, many researchers have focused on groups of children, and later adults, with high levels of SCT symptoms (Barkley, 2012a,

2013; Carlson & Mann, 2002; Garner, Marceaux, Mrug, Patterson, & Hodgens, 2010; McBurnett et al., 2001; Penny et al., 2009; Skirbekk, Hansen, Oerbeck, & Kristensen, 2011). Indeed, Penny et al. went so far as to compile a comprehensive set of SCT symptoms based on answers from experts they surveyed and their review of research papers. They then subjected the items to further analysis, ultimately creating a rating scale of the most useful set. By 2012, I had developed the first SCT rating scale for adults and published the results of the first study of adult SCT based on a representative U.S. sample of adults ages 18–92 (Barkley, 2012a), discussed further below. At the same time, I created a 12-item rating scale of SCT symptoms for children that was given to a representative sample of 1,922 U.S. parents to complete (Barkley, 2013) and that serves as the basis for this manual and the BSCTS-CA.

In summation, the construct of SCT grew out of efforts to identify differences between subtypes of ADD and subsequently children with ADHD. Whereas differences between those subtypes proved mixed, weak, and unconvincing of any substantial or qualitative differences (Willcutt et al., 2012), research focusing specifically on children (and later, adults) having high levels of SCT symptoms proved much more promising in consistently identifying a variety of distinctions from ADHD. By 2016, sufficient research on SCT made it possible to conduct a meta-analysis of the existing literature, which would conclude that on a number of variables, SCT seemed to be distinct from ADHD and worthy of much further study (Becker et al., 2016). Even so, in comparison to ADHD, the condition of SCT remains a highly understudied problem with fewer than 70 articles currently existing on SCT in children and perhaps no more than 20 on adults (Becker, Burns, Garner, et al., 2017). Increased demand for such empirically based knowledge is likely to appear due to increasing clinical referrals of cases with this condition, driven by the general public's increased awareness of SCT. The fact that SCT does not yet exist in any official taxonomy of psychiatric disorders does not alter this prediction. The increasing information on SCT at various widely visited Internet sites such as YouTube and Wikipedia, among others, will ensure a growing public demand for more scientific knowledge about SCT and its management.

What Do We Know about the Nature of SCT Compared to ADHD?

The Best Symptoms for Identifying SCT

Although there is no official symptom list for SCT, as there is for ADHD, researchers have identified its most salient symptoms (Barkley, 2012a, 2013; Becker, Leopold, et al., 2016; Becker, Burns, Garner, et al., 2017; Garner et al., 2010; McBurnett et al., 2001; Penny et al., 2009). My own research found the best symptoms for identifying SCT to be the following (Barkley, 2013): (1) daydreaming; (2) trouble staying awake/alert; (3) feeling mentally foggy/easily confused; (4) staring a lot; (5) looks/feel spacey, mind is elsewhere; (6) is lethargic; (7) is underactive; (8) is slow-moving/sluggish; (9) doesn't process questions or explanations accurately; (10) appears drowsy/sleepy; (11) appears apathetic/withdrawn; (12) is lost in thoughts; (13) slow to complete tasks; and (14) lacks initiative/effort fades. The last two symp-

toms, however, were as likely to be associated with ADHD as with SCT in children and adolescents. Therefore, they are not recommended for assisting with differential diagnosis between these two types of attention disorders (Barkley, 2013; Burns, Servera, Bernad, Carrillo, & Cardo, 2013; Lee, Burns, Snell, & McBurnett, 2013) and do not appear in the BSCTS-CA contained in this manual. But the remaining 12, among others (Becker, Burns, Garner, et al., 2017; Penny et al., 2009), are highly useful for identifying cases of SCT and so were used to form the BSCTS-CA in this manual.

Recently, the meta-analysis by Becker, Leopold, and colleagues (2016) identified a set of 13 symptoms that seemed most useful to identifying SCT, primarily in children, given that most such research in that analysis used that population. Subsequently, Becker, Burns, Garner, et al. (2017) developed a rating scale of SCT symptoms for adults, in which they studied 16 symptoms for potential use in their Adult Concentration Inventory (ACI). As is shown in Table 1.1, most of the symptoms from the meta-analysis are contained in their ACI scale. And the validation study in adults found that 10 of those symptoms on the ACI were most useful for identifying SCT in adults (distinguishing it from ADHD). Table 1.1 shows the results of these two efforts to identify the best candidate symptoms.

It should be noted that 10 of the 13 best items identified in the meta-analysis are contained on the BSCTS-CA form, and 8 of the 10 items from the adult validation

TABLE 1.1. ACI Items and Support from Meta-Analysis and Validation in Adults

ACI items	SCT meta-analysis	Validation in adults
1. I am slow at doing things.	✓	×
2. My mind feels like it is in a fog.	✓	×
3. I stare off into space.	✓	✓
4. I feel sleepy or drowsy during the day.	✓	✓
5. I lose my train of thought.	✓	✓
6. I am not very active.	✓	×
7. I get lost in my own thoughts.	✓	✓
8. I get tired easily.	✓	✓
9. I forget what I was going to say.	×	✓
10. I feel confused.	✓	✓
11. I am not motivated to do things.	✓	×
12. I zone out or space out.	✓	✓
13. My mind gets mixed up.	×	✓
14. My thinking seems slow or slowed down	✓	×
15. I daydream	✓	✓
16. I have a hard time putting my thoughts	×	×

Note. The meta-analysis is from Becker, Leopold, et al. (2016), and the adult validation study is from Becker, Burns, Garner, et al. (2017).

study likewise appear on this form. Note should be made here that symptom 11 was found in earlier research to be as much associated with ADHD as with SCT, and so was not a useful item, at least for children (discussed above). And symptoms 5, 7, 9, 13, and 16, or items similar to them, were found in factor analyses of the national survey reported later in this manual to be far more strongly associated with a dimension of executive functioning (EF) in daily life related to self-organization (Barkley Deficits in Executive Functioning Scale—Children and Adolescents [BDEFS-CA; Barkley, 2012d]) and not to SCT. So 6 of the 16 items from the meta-analysis noted in Table 1.1 should not really be used to identify SCT because they will likely contaminate the construct with either ADHD (in the case of item 11) or EF (in the case of items 5, 7, 9, 13, and 16). This is why they are not contained on the BSCTS-CA in this manual.

More recently, Becker and colleagues (Becker, Burns, Schmitt, Epstein, & Tamm, 2017) conducted a large study of 1,349 children in grades 2–5 using the following 16 items:

1. Behavior is slow (e.g., sluggish) (0.92)
2. Lost in a fog (0.89)
3. Stares blankly into space (0.96)
4. Drowsy or sleepy (yawns) during the day (0.95)
5. Daydreams (0.88)
6. Loses train of thought (0.86)
7. Low level of activity (e.g., underactive) (0.97)
8. Gets lost in own thoughts (0.81)
9. Easily tired or fatigued (1.02)
10. Forgets what was going to say (0.94)
11. Easily confused (0.91)
12. Lacks motivation to complete tasks (e.g., apathetic) (0.27)
13. Spaces or zones out (0.82)
14. Gets mixed up (0.85)
15. Thinking is slow (0.87)
16. Difficulty expressing thoughts (e.g., gets "tongue-tied") (0.78)

In their exploratory and confirmatory factor analysis (contrasting these items with those of ADHD inattention), Becker, Burns, Garner, et al. (2017) found that 15 of these 16 symptoms loaded highly on an SCT factor (factor loadings are in parentheses beside each symptom) and not significantly on the ADHD inattention factor. Item 12 did not, however; it was far more highly linked to the ADHD inattention symptom dimension. As noted previously, this finding again corroborates earlier research that this item dealing with motivation is not a good symptom for identifying SCT from ADHD.

Of the remaining 15 symptoms, the authors found that item 14 (Gets mixed up) was highly correlated and thus redundant with item 11 (Easily confused) and so is unnecessary to include in a symptom list. And items 6, 10, and 16, dealing with problems organizing and expressing thoughts, were found to be most highly associated with that dimension of EF in daily life related to self-organization, not

to SCT, in the factor analysis to be reported later. The Becker, Burns, Schmitt, et al. (2017) study did not use any measures of EF in daily life, and so these three items appeared to load instead on their SCT dimension. As discussed below, prior research has shown that SCT has a small but significant association with this dimension of EF, so it is not surprising that in the absence of any EF measures, these items would seem to align with SCT. Yet given the opportunity to be analyzed alongside other EF symptoms, these apparent SCT symptoms then migrate over to the self-organization dimension of EF and do not remain useful SCT items. For this reason, I again do not believe they should appear on a list of the best items for identifying SCT.

With these issues in mind, that leaves just 11 of the 16 items on the preceding list as representing the best symptoms for identifying SCT. All 11 of these symptoms appear on the BSCTS-CA, though not necessarily worded exactly as they appear here. Also, two (2 and 11) of the symptoms on the preceding list are contained in a single item on the BSCTS-CA (Mentally foggy or easily confused). And the BSCTS-CA has an extra symptom reflecting difficulties remaining alert or awake that does not appear on the Becker, Burns, Schmitt, et al. list. Item 15 (Thinking is slow) is represented on the BSCTS-CA as "Doesn't seem to understand or process questions or explanations as quickly or accurately as others." More on the phrasing and derivation of the SCT symptoms on the BSCTS-CA is presented in subsequent chapters, including the results of my factor analysis in comparison to ADHD and EF symptoms.

Thus, for now, it is safe to say that the BSCTS-CA utilizes the vast majority, if not all, of the best symptoms identified in prior research as optimal for differentiating SCT from ADHD, as well as other disorders and EF, even though it was initially developed prior to these two research reports by Becker and colleagues.

The Symptom Dimensions Are Distinct from ADHD

In prior research the symptoms of SCT seem to form either a single factor (Becker, Burns, Schmitt, et al., 2017) or at least two factors or dimensions. Those two identified dimensions are intercorrelated sufficiently to be combined in identifying this disorder. Most commonly, the two dimensions identified in factor-analytic research are a Daydreamy/Spacey factor and a Sleepy/Sluggish/Underactive dimension or factor (Barkley, 2013; Burns et al., 2013; Jacobson et al., 2012; Mueller et al., 2014; Penny et al., 2009). In a study of adolescents with ADHD, a Sleepy dimension emerged that was somewhat distinct from the Daydreamy and Sluggish factors (Smith & Langberg, 2017), but this is not the case in studies of children or when child and teenage samples are combined (Barkley, 2013). In some studies, a separate factor is found for the low initiative and lack of persistence items (see 13 and 14 above). But as noted, these two seem to be more related to ADHD inattentive symptoms than to SCT and thus would not be useful in differentiating SCT from ADHD (Barkley, 2013). Interestingly, as with ADHD, there is a cognitive-inattentive dimension (Daydreamy/Spacey) and a motor dimension (Sluggish/Lethargic) to SCT, though they are clearly different from the symptoms comprising those general dimensions in ADHD. Smith and Langberg (2017) have argued that, at least in

adolescents with ADHD, a multidimensional view of SCT, as discussed previously, is preferable to a unidimensional view, given that the different dimensions appear to predict different forms of impairment (academic vs. internalizing problems).

The distinctiveness of SCT and its factors from those of ADHD have been evident across all of the various approaches to measurement studied to date, such as parent and teacher ratings (Barkley, 2013; Bauermeister, Barkley, Bauermeister, Martinez, & McBurnett, 2012; Becker, Burns, Schmitt, et al., 2017; Becker, Luebbe, Fite, Stoppelbein, & Greening, 2014; Burns et al., 2013; Garner et al., 2010; Hartman, Willcutt, Rhee, & Pennington, 2004; Jacobson et al., 2012; Lee et al., 2013; McBurnett, Villodas, Burns, Hinshaw, Beaulieu, & Pfiffner, 2014; Penny et al., 2009; Willcutt et al., 2013), observations of behavior at school (McConaughy, Ivanova, Antshel, Eiraldi, & Dumenci, 2009), and observations of behavior in clinical settings (McConaughy, Ivanova, Antshel, & Eiraldi, 2009). SCT symptoms are distinct not only from those of children with ADHD (Barkley, 2013) and youth (Smith & Langberg, 2017), but are also found to be distinct from those of adults with ADHD in self-reports for ages 18–89 years (Barkley, 2012a) and among college students (Becker, Burns, Garner, et al., 2017).

Despite finding SCT symptoms to be distinct from those of ADHD across ages, measures, and even sources, they may not necessarily correlate strongly across measurement sources. For instance, several studies have found only a low-to-moderate relationship between parent and teacher rated symptoms (*r*s = .29–.38; Koriakin, Mahone, & Jacobson, 2015; Markovich-Pilon, Corkum, & Joyce, 2017), showing that at most, these ratings share just 14% of their variance. Although disappointing, such correlations are in keeping with the usual and modest levels of association found between parent and teacher ratings of all dimensions of child psychopathology (Achenbach, McConaughy, & Howell, 1987).

SCT Symptoms Are Moderately Related to ADHD Inattention but Not to Hyperactivity–Impulsivity

SCT symptoms have been found repeatedly to be significantly but moderately correlated with the ADHD inattention symptom dimension, suggesting about 25–36% shared variance between the two dimensions. Hence, they are not identical, nor do they approach colinearity as if they derived from the same item pool or construct. Moreover, SCT symptoms identify a unique group of children even within samples that include ADHD inattentive type (Capdivila-Brophy et al., 2012; Marshall, Evans, Eiraldi, Becker, & Power, 2013). Yet SCT symptoms are substantially less correlated with ADHD symptoms than they are with each other (Barkley, 2012a, 2013; Penney et al., 2009). A number of studies find that SCT symptoms demonstrate a much weaker relationship to hyperactive–impulsive symptoms, if at all, than they do to inattention symptoms (Barkley, 2012a, 2012b; Burns et al., 2013; Hartman et al., 2004; Garner et al., 2010; Jacobson et al., 2012; Penny et al., 2009; Wahlstedt & Bohlin, 2010). In fact, this relationship may become negative, at least for the SCT slowness dimension, once ADHD inattention is statistically removed (Lee et al., 2013; Penny et al., 2009). All of this is to say that the structure of SCT symptoms is not merely a reflection or broadening of the ADHD inattention symptom dimension.

Instead, SCT symptoms are as independent or as only partially coupled to ADHD symptoms as are other symptom dimensions of child and adult psychopathology to each other.

SCT Symptoms Are Evident and Valid in Other Cultures/Countries

A small but growing body of evidence indicates that SCT symptoms can be identified in samples from other countries and cultures, and that they show a similar pattern of distinctiveness from ADHD symptoms. Thus there is cross-cultural validity to this condition, at least as examined to date. Studies using samples of children from *Canada* (Markovich-Pilon et al., 2017), *Spain* (Burns et al., 2013; Camprodon-Rosanas et al., 2017a; Camprodon-Rosanas et al., 2017b; Preszler et al., 2017), *Korea* (Lee, Burns, & Becker, 2016), *Nepal* (Khada, Burns, & Becker, 2016), and *Chile* (Belmar, Servera, Becker, & Burns, 2015) all attest to the existence and validity of SCT within these countries as a distinct condition from ADHD, so it is not strictly a U.S. phenomenon. This cross-cultural existence and validity are true of ADHD as well.

In sum, individual studies and meta-analyses of symptoms of SCT show that they:

- Are coherent among themselves (more highly correlated with each other than with symptoms of other disorders, e.g., ADHD).
- Form a distinct dimension or set of dimensions of symptoms from those comprising other disorders, such as ADHD, anxiety, and depression.
- Are internally consistent (high internal reliability).
- Show reasonable test–retest reliability over short time periods (Becker et al., 2016).
- Have significant stability and invariance over long periods, from 2 (Servera, Bernad, Carillo, Collado, & Burns, 2016) to 9 years (Leopold et al., 2016).
- Show comparable low-to-moderate relationships between parent and teacher ratings, as seen in other child psychopathologies.
- Are evident cross-culturally.

Demographic Differences in SCT and ADHD

Relationships to Age and Sex

Only a handful of prior studies examined parental/family demographic characteristics of SCT versus ADHD. Several studies (Garner et al., 2010; Jacobson et al., 2012) found that SCT was not related to child age, gender, or minority status. This same pattern was evident in my two large epidemiological studies of representative samples of U.S. children (Barkley, 2013) and adults (Barkley, 2012a) across ages 6–89 years. This was also the conclusion of the meta-analysis by Becker, Leopold, Burns, and colleagues (2016), in which only a slight relationship of SCT symptoms to age was noted. In ADHD, however, the symptoms decline with age across childhood, especially those of hyperactive–impulsive symptoms. Groups having SCT have also

been noted to be older than those having ADHD (Becker, Leopold, Burns, et al., 2016), implying a somewhat later age of onset for the former symptoms.

Boys demonstrated more ADHD symptoms than girls during childhood and adolescence but come close to being nearly equal in adulthood (Barkley, 2012a, 2013; Burns et al., 2013). This is not the case for SCT: Males have only a slightly greater number of symptoms than females in childhood and no evident sex differences in symptom occurrence by adulthood (Barkley, 2012a, 2013; Becker, Burns, Schmitt, et al., 2017; Burns et al., 2013). This lack of, or very small association of, SCT with age and sex was also evident in a study by Lee et al. (2013), who noted no sex differences and no effect of age on teacher ratings and only a very small difference due to those demographic factors in parent ratings.

Some studies have found ADHD symptoms to be slightly but statistically significantly associated with some ethnic groups (e.g., Hispanic/Latino) more than others, whereas this is not the case for SCT symptoms, either in large nationally representative samples (Barkley, 2012a, 2013) or in the meta-analysis by Becker, Leopold, and colleagues (2016).

Relations with Parental Factors

In my national survey of children (Barkley, 2013), I noted that SCT was linked to lower parental education, lower annual household income, and a greater likelihood of a parent being out of work due to disability. A study in Spain also noted an association of this symptom dimension with paternal unemployment and low maternal education in a large sample of Catalan school children (Camprodon-Rosanas et al., 2017b). My survey of U.S. adults (Barkley, 2012a) similarly found that those classified as SCT had less education and less annual income. In those instances where SCT was comorbid with ADHD in the adult survey (Barkley, 2012a), those individuals were more likely to be unmarried and out of work on disability than were adults with ADHD. Such findings intimate that SCT might be more associated with psychosocial adversity or stressors than is ADHD. But the meta-analysis by Becker, Leopold, and colleagues (2016) concluded that SCT might be less related to such parental demographic features than ADHD. To summarize, what patterns emerge in results to date indicate that the demographic correlates associated with SCT may be different from, or far weaker than, those evident in ADHD.

Differences in Psychometrically Assessed Cognitive Functioning

In general, there has been vastly less research on the neuropsychological deficits associated with SCT compared to ADHD, where the research literature is abundant (Frazier, Demaree, & Youngstrom, 2004; Hervey, Epstein, & Curry, 2004; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005; Willcutt, 2015). Studies are not consistent in showing a relationship of SCT to lower levels of intelligence. But the bulk of the evidence suggests a significant but modest negative relationship (Becker, Leopold, et al., 2016) that may be most evident when teacher-rated SCT is the source rather than parent ratings (Markovich-Pilon et al., 2017).

A few studies imply that SCT may involve deficits in early information processing or selective attention that is not typical of ADHD (Huang-Pollack, Nigg, & Carr,

2005). One recent study suggests that preschoolers with high SCT ratings may be more impaired on tests of visual–perceptual abilities, auditory and visual attention, sustained and selective attention, inhibitory control, and prenumerical/numerical concepts, even after controlling for ADHD inattention (Tamm, Brenner, Bamberger, & Becker, 2018). Variability of spatial memory performance has also been specifically linked to SCT but not to ADHD in the Skirbekk et al. (2011) study, even after controlling for IQ, ADHD inattention, and other variables. But such findings from so few studies must be replicated in more research before being viewed as confirmed correlates of SCT.

Likewise, slower processing or motor speed has been linked to hypoactivity specifically (Lundervold, Posserud, Ullebo, Sorensen, & Gillberg, 2011) and to SCT symptoms more generally in some studies of children (Adams, Milich, & Fillmore, 2010; Camprodon-Rosanas et al., 2017a; Garner et al., 2010; Jacobson, Geist, & Mahone, 2017), consistent with SCT's symptom profile. One recent study (Camprodon-Rosanas et al., 2017a) found that teacher-rated SCT symptoms were significantly though modestly correlated with poorer performance on both a working memory (WM) task and the response parameter scores (mean reaction time, reaction time variability) of the attention network task (ANT) with *r*s = –.17–.20 for WM and .20–.22 for ANT. But there was no association of SCT with those scores on the ANT linked to different attention networks (Alerting, Orienting, Conflict). And only the relationship of SCT to slow mean reaction time on the ANT remained significant after controlling for potential confounding variables, including ADHD inattention. In contrast, on reaction time tasks ADHD is repeatedly associated with greater variability of reaction times (Frazier et al., 2004; Hervey et al., 2004; Willcutt et al., 2005).

One question raised by such findings is whether this problem of slow or sluggish speed in responding is the result of difficulties on the information-processing side (perceptual speed) or the motor preparatory and execution side, or both (Jacobson et al., 2017). Current research has not been able to address this issue satisfactorily, yet the results of the Camprodon-Rosanas et al. (2017a) study noted previously imply that it may be more of a motor slowing problem. And the problem of speed, wherever it arises, may not be so evident in older children (Jacobson et al., 2017) and perhaps not at all by college age (Wood, Potts, Lewandowski, & Lovett, 2016). However, as several studies found (e.g., Camprodon-Rosasnas et al., 2017; Jacobson et al., 2017), even this association with slow speed in younger children is small and hardly convincing of it being the core deficit in SCT, as its name clearly implies. Furthermore, others (Bauermeister et al., 2012) did not replicate this finding of slow perceptual–motor or processing speed, despite studying children. Again, replication of such findings is essential before one can have confidence in their linkage to SCT. The meta-analysis of SCT research by Becker, Leopold, and colleagues (2016) likewise concluded that the neurocognitive research on SCT is too scant to draw any firm conclusions.

Only a few studies using psychometric tests of EF specifically have been done with individuals selected for SCT. Unlike ADHD, results intimate that SCT is not as serious and pervasive a disorder of EF, if it involves psychometrically assessed EF at all (Bauermeister et al., 2012; Wahlsted & Bohlin, 2010). In contrast, research is ubiquitous showing that in ADHD, for instance, there are deficits on tests of inhibi-

tion and WM, especially nonverbal WM (Frazier et al., 2004; Hervey et al., 2004; Willcutt et al., 2005; Willcutt, 2015). In contrast, this is not seen in SCT; research shows that it is ADHD inattention that is most closely linked to impaired EF test performance. When covaried out of analyses of SCT effects on EF, the result is often one of nonsignificance (Bauermeister et al., 2012; Camprodon-Rosanas et al., 2017a). But the research here is so limited as to preclude any firm conclusions being drawn. Moreover, EF tests have low or no ecological validity and low or no relationships to various domains of impairment, in contrast to ratings of EF (Barkley, 2012b; Barkley & Fischer, 2011; Barkley & Murphy, 2010). And so EF tests cannot serve as the gold or sole standard for examining EF deficits in SCT (or any other disorder). Given their greater ecological validity and predictive power for impairment, EF ratings may provide a different pattern of results for SCT than do EF tests.

Just a few studies have used EF ratings to study individuals with SCT. For instance, my own large studies (Barkley, 2012a, 2013) used my rating scale of EF in daily life with large, epidemiologically derived samples of children and adults having SCT, ADHD, or both. Results for the childhood survey showed that SCT had only very weak relationships to four of the five EF deficit dimensions (<1% shared variance) when statistically controlling for its association with ADHD symptoms, especially the inattention dimension. On one dimension (Planning and Problem-Solving) there was a slightly higher contribution (<5%) after such statistical control. A more recent study of adults with ADHD likewise found that SCT symptoms contributed primarily to the self-organization dimension of EF ratings but not to the other dimensions, once ADHD symptoms were statistically controlled (Leikauf & Solanto, 2017). A study of preschoolers similarly found that parent- and teacher-rated SCT symptoms in the children were not related to ratings of EF in daily life (Tamm, Brenner, et al., 2018). And as explained in Chapter 3 of this manual, when SCT symptoms are factor-analyzed with ratings of EF in daily life, the two dimensions of SCT merge as being distinct from those of EF. This is not the case for ADHD symptoms, which can be found to cross-load onto dimensions of EF rather than forming separate dimensions from them. Again, this implies that ADHD is very much a disorder of EF, whereas SCT is not.

Several studies of college students (Becker et al., 2017; Jarrett, Rapport, Rondon, & Becker, 2014; Wood, Lewandowski, Lovett, & Antshel, 2017) did find some unique contribution of SCT symptoms to some dimensions of EF in daily life independent of ADHD inattention, but typically of a much smaller magnitude than is the case for ADHD inattention. The only exception is in the self-regulation of emotion: Becker et al. (2017) found that SCT symptoms made an equal contribution compared to the two dimensions of ADHD, whereas Jarrett et al. (2014) found that only SCT made such a contribution, controlling for ADHD inattention. This may be the case for adults with SCT symptoms, as was also found in my own U.S. survey of adults, but that was not the case in the survey of U.S. children. So, there may be some age-related changes in this relationship worth further study. Overall, it is the inattentive dimension of ADHD that contributes to the vast majority of variance across most EF dimensions on EF rating scales, with the hyperactive–impulsive dimension accounting for a lesser but still significant degree of variance, especially on the EF dimensions of Self-Restraint (inhibition) and Emotional Self-Regulation. From these results, it seems that SCT is not nearly as much of a disorder of EF, if it

is at all, as is ADHD, which is massively so on such ratings. Indeed, ADHD inattention symptoms account for 8–20 times as much variance in most dimensions of EF ratings than do SCT symptoms.

Using a different rating scale of EF, Becker and Langberg (2014) also found a smaller contribution of SCT to the metacognitive factor on the Behavior Rating Inventory of Executive Functioning, in comparison to the inattentive symptoms of ADHD. So did Jimenez and colleagues, even after controlling for ADHD inattention (Jimenez, Ballabriga, Martin, Arrufat, & Giacobo, 2013).

A small link of SCT to EF-like problems was also evident in the study by Langberg and colleagues (Langberg, Becker, & Dvorsky, 2014), but only for parent-reported organizational problems. Yet only ADHD inattention symptoms linked up with organizational problems, as rated by teachers. It is possible that problems with certain aspects of WM may be weakly related or possibly secondary to the cognitive SCT daydreaming dimension. I believe those WM/organizational problems hardly compare to the more severe and pervasive EF deficits so evident in ratings of daily life for children and adults with ADHD (Barkley, 2012a, 2013) and that correlate so much more strongly with ADHD inattention symptoms. Moreover, it is clear across all of these studies utilizing EF rating scales that SCT has no significant association with EF inhibitory problems, whereas those inhibitory problems are substantial in ADHD.

Overlap of ADHD and SCT

In the majority of research on SCT, samples were selected from among children referred to clinics for concerns about ADHD; indeed, in some a diagnosis of some type of ADHD (via DSM-IV criteria) was the starting point. This selection process can automatically make it seem as if SCT were highly associated with, and hence a subtype of, ADHD in the results of such research if any differences emerge at all. It also means one cannot study the overlap or independence of the disorders, given the confounding starting point of case selection. In contrast, if SCT cases are selected specifically from general population or general outpatient clinic samples, there is the opportunity to investigate SCT independently of ADHD, and so the comorbidity between the two could be studied. I did so in my two national surveys (Barkley, 2012a, 2013), wherein I found that more than half (59%) of the children qualifying for a research diagnosis of SCT also met research criteria for having ADHD. Markovich-Pilon et al. (2017) likewise found a high rate of ADHD (40%) in Canadian children referred to an ADHD clinic who were subsequently classified as having high levels of SCT symptoms. But this finding did not differ significantly from the rate (29%) found in those referred children rated low in SCT symptoms, perhaps due to low statistical power in the study design. A few studies suggest that it is among those ADHD subtypes having significant inattention symptoms, rather than with the predominantly hyperactive–impulsive type, that one is most likely to find the overlap with SCT (Garner et al., 2010; Penny et al., 2009; Skirbekk et al., 2011). In my survey, only 39% of the children qualifying for ADHD of any type also qualified for SCT. Again, these findings agree with prior studies of children (Garner et al., 2010; Hartman et al., 2004) and adults (Barkley, 2012a). For instance, one survey of U.S. adults (Barkley, 2012a) found that 5.8% of the sample met crite-

ria for high SCT symptoms. Approximately half (54%) of those participants qualifying for SCT had ADHD, yet nearly half did not. Similarly, approximately half of individuals qualifying for ADHD of any type (46%) also qualified for SCT. It seems to me that the relationship of SCT to ADHD evident in these findings is one of comorbidity between two relatively distinct but related or partially coupled disorders, such as exists between anxiety and depression, and not one of subtyping within a single shared disorder. More research will help clarify if this distinction is, in fact, the case.

Patterns of Comorbidity

SCT symptoms are often linked to elevated ratings of *internalizing symptoms* generally than are ADHD symptoms (Bauermeister et al., 2012; Becker & Langberg, 2013; Becker et al., 2014; Capdevila-Brophy et al., 2012; Carlson & Mann, 2002; Garner et al., 2010; Hartman et al., 2004; Penny et al., 2009; Smith & Langberg, 2017), especially the Slow dimension (Smith & Langberg, 2017). This is so even after controlling for ADHD symptoms (Bauermeister et al., 2012; Becker & Langberg, 2013; Becker, Langberg, Luebbe, Dvorsky, & Flannery, 2014; Burns et al., 2013; Jacobson et al., 2017; Lee et al., 2013; Penny et al., 2009; Willcutt et al., 2013). Among adolescents with ADHD, self-report of SCT was more strongly predictive of internalizing symptoms than were parent reports, which better predicted academic impairment (Smith & Langberg, 2017). This linkage of SCT to internalizing symptoms is undoubtedly one of the most reliable findings in the literature on SCT in child, teen, and adult samples. When the inverse is done, such that SCT symptoms are statistically removed, the inattention dimension of ADHD may be less or even unrelated to internalizing symptoms (Lee et al., 2013; Penny et al., 2009) or even to ratings of social problems (Becker et al., 2014).

The relationships of SCT to *anxiety* and *depression* are positive (Lee et al., 2013), not surprisingly, given that the latter two conditions are often combined in ratings of internalizing symptoms. SCT may predict both of these internalizing dimensions (anxiety, depression) even after controlling for the overlap of the latter dimensions with each other (Becker et al., 2014). The association with depression may be stronger than that with anxiety (Cortes et al., 2017) and remains even after controlling for parental internalizing dimensions, as was done by Becker et al. (2013). Although a few exceptions exist in this literature (Burns et al., 2013; Harrington & Waldman, 2010; Wahlstedt & Bohlin, 2010), the weight of the evidence finds SCT to be more closely related to internalizing symptoms (anxiety, depression, withdrawal) than is ADHD (Becker, Leopold, et al., 2016; Becker et al., 2017). There is a pattern here of a double dissociation between the two disorders in their linkage to internalizing symptoms that is evidence that they are distinct conditions from each other, not subtypes of a common disorder.

There is a lack of association of SCT with *oppositional defiant disorder* (ODD; Barkley, 2013). Furthermore, there is more recent evidence that the relationships may be negative ones when ADHD inattention is removed statistically in the analyses (Cortes et al., 2017). So it can be reasoned that SCT also would have little or no associations with conduct disorder (Cortes et al., 2017), substance use disorders, or adult antisocial personality disorder. That is because all of these risks are linked,

to varying degrees, with ODD or the hyperactive–impulsive symptom dimension of ADHD, with which SCT is unassociated. Further evidence for this lack of, or even negative association with, externalizing disorders is evident in a study using direct observations of disciplinary actions (time-outs) received on an inpatient unit (Becker et al., 2014). Such disciplinary actions, often instituted for disruptive or aggressive behavior, were positively linked to the hyperactive–impulsive symptoms of ADHD but negatively associated with SCT symptom severity. This finding is yet another double dissociation supporting the distinctiveness of SCT from ADHD.

One prior study examined the relationship of SCT versus ADHD to specific professional diagnoses of *17 different learning, developmental, and psychiatric disorders*, as reported by parents asked to identify the past professional diagnoses their children had received (Barkley, 2013). This research found that both SCT and ADHD were associated with elevated rates of comorbidity for 11 of the 17 disorders. But SCT was not associated with higher rates of reading or math disorders, hearing impairment, ODD, anxiety, or bipolar disorder diagnoses than the controls. ADHD was linked to higher rates for all of these disorders except hearing impairments. Unlike ADHD, the SCT group had a higher rate of depression than either the controls or those with ADHD, consistent with other studies already cited that found such an association with ratings of depression. The comorbidity of ADHD and SCT was associated with higher rates of comorbidity for most disorders than was either disorder alone. This finding implies an additive effect of SCT and ADHD when they exist together, as if each were a distinct disorder that rendered greater risks when comorbid. Or this pattern could have arisen merely as a function of symptom severity: That is, individuals with comorbid disorders had more symptoms of both disorders than was the case for each specific disorder group.

Even so, another study using Canadian children referred to an ADHD clinic did not find any differences in rates of comorbidity between the children with high versus low SCT symptoms (Markovich-Pilon et al., 2017). This finding is in contrast to the repeated linkage of SCT with internalizing symptoms generally and depression, as noted above. Perhaps it results from a referral bias, however, as clinic-referred children are more likely to have comorbid disorders than are nonreferred children identified as disordered in epidemiological samples (Angold, Costello, & Erkanli, 1999).

One recent study evaluated the extent to which SCT and ADHD symptoms were related to dimensions of *psychopathy* in a large sample ($N = 198$) of inpatient child mental health admissions (Raiker et al., 2015). The two dimensions of psychopathy (psychopathy–impulsivity and narcissism) mediated the linkage between ADHD symptoms and social problems, whereas the symptoms of SCT were unrelated to psychopathy after controlling for their overlap with ADHD.

Domains of Impairment

For a condition to rise to the level of being a mental disorder, there must be evidence of impairment or harm (adverse consequences) to the individual from those symptoms (American Psychiatric Association, 2013). We can think of symptoms as the cognitive, emotional, and behavioral expressions of a disorder, whereas impairment represents the consequences that flow from such symptoms.

Social Functioning

Studies of individuals with SCT symptoms have routinely shown them linked to social problems generally and to social withdrawal specifically (Becker & Langberg, 2013; Becker et al., 2014; Burns et al., 2013; Capdevila-Brophy et al., 2012; Camprodon-Rosanas et al., 2017b; Garner et al., 2010; Marshall et al., 2013; Willcutt et al., 2013), even in the presence of high ADHD inattention symptoms (Capdevila-Brophy et al., 2012) or after controlling for the overlap of ADHD inattention symptoms with those of SCT (Becker, Burns, Schmitt, et al., 2017). Such findings may be even more apparent in teacher than in parent ratings (Bauermeister et al., 2012; Becker & Langberg, 2013). This may be one of the most well-documented associations of SCT with any domain of impairment (Becker, Leopold, et al., 2016), and it differs markedly from the relationship of ADHD to social aggression and peer rejection (McQuade & Hoza, 2015).

Mikami and colleagues (Mikami, Huang-Pollack, Pfiffner, McBurnett, & Hangai, 2007) have provided the only study to date involving detailed observations of the social interactions of children with SCT, using a simulated chat room with children with ADHD and controls. They statistically controlled for ADHD type, IQ, reading ability, and typing skill in their analyses. SCT was noted to independently predict fewer total responses in the chat room, less perception of subtle social cues, less memory for the conversation, and a smaller proportion of hostile responses. While these findings agree with the more general findings that individuals with SCT are more socially withdrawn, they also suggest a role of SCT in attention and an encoding dysfunction that accounts for impairment in critical social behaviors that are of a different sort than seen ADHD (social intrusion, aggression, bossiness, excessive speech, etc.).

Noteworthy is the finding that the association of SCT to social impairment or withdrawal remains even after statistically removing ADHD symptoms as well as those of ODD, conduct disorder, generalized anxiety disorder, major depressive disorder, and IQ (Becker et al., 2016). SCT and the inattention dimension of ADHD both contribute to variance in the presence of social problems and apparently peer neglect, yet their contributions are independent or additive, not redundant (Burns et al., 2013; Willcutt et al., 2013). Similarly, the study by Becker et al. (2013) found that the positive association of SCT with general social problems was apparently not due to disruptive social problems, given the association noted above with significantly lower rates of discipline in inpatient children. This relationship of SCT to social withdrawal persists even after controlling for demographic factors and comorbidity (Becker, Leopold, et al., 2016). Thus SCT contributes unique variance to certain areas of social impairment independent of other disorders, including ADHD.

Academic Functioning

Bauermeister et al. (2012) found that both SCT and ADHD inattention were each significantly and independently associated with lower academic achievement scores on testing after controlling for the other set of symptoms, whereas hyperactive–impulsive symptoms showed no such relationship. Markovich-Pilon et al. (2017) also

found a weak negative relationship of SCT symptoms with academic achievement tests ($r = -.22$), albeit barely significant, but only for teacher-rated SCT symptoms. In contrast, three studies (Becker & Langberg, 2013; Langberg et al., 2014; Watabe, Owens, Evans, & Brandt, 2013) either did not find an association of SCT symptoms with academic achievement test performances after controlling for IQ and ADHD symptoms, or found it to be rather weak. Again, the source of the ratings of SCT may account for this disparity in results across studies on achievement tests.

A few studies found that SCT symptoms may be uniquely associated with deficient math performance (Bauermeister et al., 2012; Tamm, Garner, et al., 2016). Again, the source of the ratings may be relevant to such findings, in that they may be more evident in teacher- than in parent-rated SCT symptoms.

Others have found some measures of SCT symptoms to be uniquely linked to problems with writing (but not reading). However, once again these relationships varied depending on source (parent vs. teacher ratings; Tamm, Garner, et al., 2016) with stronger associations evident in teacher- than in parent-rated SCT symptoms, just as Markovich-Pilon et al. (2017) found (above).

In contrast to these mixed results using academic test performances, far stronger associations have been found for SCT symptoms when ratings of academic impairment are used (Burns et al., 2013; Tamm, Garner, et al., 2016). Like Burns et al. (2013), Camprodon-Rosanas et al. (2017b) noted this same relationship in Spanish children. Likewise, Flannery, Luebbe, and Becker (2017) found SCT symptoms to be uniquely linked to poorer study skills and globally rated educational impairment. Such relationships are evident even after controlling for ADHD inattention symptoms in the preceding and other studies (Becker, Burns, Schmitt, et al., 2017). The results of the study by Tamm, Garner, et al. (2016) indicate that it is the Slow or Sluggish dimension of SCT symptoms and not the Daydreamy/Spacey dimension that is related to academic impairment ratings. Smith and Langberg (2017) found the same result in a study of teens with ADHD, particularly for parent ratings of that SCT Slow dimension. In contrast, youth self-report in that study was more strongly predictive of internalizing symptoms. Further evidence of academic functioning difficulties being linked to high SCT symptoms comes from a recent study by Shelton and colleagues (Shelton, Addison, & Hartung, 2017). They found SCT symptoms to be uniquely associated with certain self-regulated learning (SRL) strategies in college students apart from the SRL deficits linked to ADHD symptoms. Likewise, Becker and colleagues found a relationship of SCT symptoms to poor academic functioning in college students (Becker et al., 2014).

The reason for the differences in results concerning academic functioning is obvious. It is the type of measurement of academic functioning and achievement being used in the study. Ratings of academic functioning in daily life are linked in specific and unique ways to SCT symptoms, independent of those related to ADHD, which may not be evident when psychometric tests of certain academic achievement skills are studied for their relationship to SCT.

Why else might there be a disparity across these studies besides measurement type? It may arise from the fact that some studies selected their samples for ADHD first and then within such samples, examined those high and low in SCT symptoms or examined the relationship of SCT to other correlates. This method can contami-

nate any findings for SCT with those results related to ADHD. Even so, when symptoms of ADHD are statistically removed, SCT appears to add unique variance to the prediction of academic problems (Barkley, 2013; Becker, Leopold, et al., 2016; Becker, Burns, Schmitt, et al., 2017; Smith & Langberg, 2017) and may make unique contributions to written language, organization problems, and homework specifically beyond the contribution of ADHD inattention symptoms (Langberg, Becker, & Dvorsky, 2014; Marshall et al., 2013; Willcutt et al., 2013).

Sleep

Given that problems with alertness, remaining awake, and even daytime sleepiness have been used as symptoms to index the presence of SCT (Penny et al., 2009), it is not surprising that the condition has been challenged for being a mere proxy of hypersomnia, or excess sleepiness. So, for SCT to be established as a unique condition from other psychiatric or psychological problems, its relative independence from daytime drowsiness and nighttime sleep problems needs to be established. Several recent studies have now done so. A study of 7,346 clinic-referred children evaluated this relationship (Koriakin et al., 2015). Parent and teacher ratings were used to assess ADHD, SCT, anxiety, and depression symptoms along with parent reports of sleep problems. Controlling for ADHD, anxiety, depression, age, and medication status, the study showed only difficulty waking was significantly related to SCT, but only parent-rated and not teacher-rated. This relationship was primarily with the Sleepy/Sluggish dimension of SCT, as one might expect. Another recent study examined 325 children referred to a sleep disorders clinic at a major children's hospital (Becker, Garner, et al., 2016). It found that SCT was weakly linked to most measures of sleep but moderately correlated (.33–.53) with daytime sleepiness, after controlling for child demographic factors, corroborating the Koriakin et al. (2015) findings. Further corroboration comes from a recent study of children referred to a Canadian ADHD clinic (Markovich-Pilon et al., 2017), in which, again, only parent-rated SCT, but not teacher-rated, was associated with daytime sleepiness, but not with nighttime sleeping problems or duration. Thus, only parent-rated SCT symptoms in children, especially along the Sleepy/Sluggish dimension, may share about 10–30% of variance with daytime sleepiness. This is not true of teacher-rated SCT. The finding for parent ratings is not surprising, given the inclusion of some items pertaining to sleepy/drowsy in SCT ratings.

A study of college students (Becker, Luebbe, & Langberg, 2014) likewise found a significant association of SCT symptoms, but not ADHD inattention, with poorer sleep quality and increased nighttime sleep disturbance. Yet both SCT and ADHD inattention were associated with greater daytime dysfunction, above and beyond those nighttime sleep disturbances. In contrast, ADHD hyperactivity symptoms were linked to poorer sleep quality, longer sleep latency, shorter sleep duration, and more use of sleep medications. But the small degree of the association in these studies, even if significant, means that SCT is not simply serving as a proxy for hypersomnia, daytime sleepiness, or sleeping difficulties, although it may be comorbid with, and possibly contributory to, both nighttime sleep problems and daytime dysfunction.

Driving

Only one study to date has examined the relationship of SCT to driving problems (Garner et al., 2016) experienced by 16- to 18-year-old adolescents with a history of chronically short sleep (5–7 hours). Results found that parent-reported (but not self-reported) symptoms of SCT were significantly associated with driving violations (self-reported). In contrast, ADHD symptoms show a more marked and pervasive adverse relationship to various measures of driving performance and outcomes (Barkley, 2015c). Of interest to clinicians is that a treatment program intended to increase sleep time in these adolescents resulted in both a reduction in SCT symptoms and in fewer driving problems.

Global Impairment

In addition to social and academic domains, my own national surveys of children and adults included a measure of 15 domains of impairment (Barkley, 2012a, 2013). Individuals were sorted into those who had SCT only, those with ADHD only, those with both conditions, and the remainder serving as the community control group. Individuals with SCT were more impaired in all domains than control cases, having their greatest difficulties in community–leisure domains more than in home–school (work) domains. In contrast, although individuals with ADHD were also impaired across all domains, their greatest difficulties occurred in home–school domains. Moreover, ADHD was associated with more pervasive impairment. That is, both ADHD groups (alone and combined with SCT) experienced impairment in at least twice as many of the 15 domains as did those with SCT. The results also showed that ADHD symptom dimensions, especially inattention, contributed markedly more variance to impairment in the home–school domains than did hyperactive–impulsive or SCT dimensions. By contrast, the hyperactive–impulsive dimension contributed more variance to community–leisure impairments, as did SCT, but to a far lesser extent. When considering individual domains among the 15 rated, SCT was not found to be more impairing than ADHD in educational settings, at least as rated by parents, consistent with other research discussed previously. When ADHD and SCT symptoms were regressed onto the community–leisure and home–school impairment summary scores, results found that both contributed uniquely to impairment, although ADHD accounted for a greater proportion of variance in each summary score. Hence, in children, SCT is a less impairing disorder than ADHD, though hardly benign.

The adult survey (Barkley, 2012a) also used a rating scale of impairment in 15 domains more appropriate to adults. Both the SCT-only and ADHD-only groups were more impaired than the control group but did not differ in this respect in overall mean impairment. A somewhat different pattern was evident for the percentage of domains in which impairment occurred (pervasiveness). Here, both of the ADHD groups (ADHD alone, ADHD+SCT) were impaired in more domains than was the SCT-only group and the control group. The results further revealed that the SCT-only group was impaired in more domains than the control group of adults, but not to the degree evident in the ADHD groups. These results are consistent with the more recent large-scale study of college students by Becker and

colleagues (2017), in that impairment is certainly linked to SCT in distinct ways, than is ADHD but may not be so impairing as ADHD. A separate study of college students also found SCT to be uniquely linked to global impairment as well as to the specific domains of education, work, money and finances, managing household tasks and chores, community activities, and social situations, despite controlling for ADHD symptoms and anxiety and depression ratings (Flannery et al., 2017).

It is noteworthy that in both of my large U.S. studies, when comorbid, ADHD+SCT disorders were additive in their impact on impairment ratings. That is, the combination of disorders resulted in far more severe impairment and more domains of impairment than either disorder alone.

Quality of Life

Combs and colleagues have also studied the linkage of SCT to some aspects of impairment in large adult community samples (Combs, Canu, Broman, & Nieman, 2013; Combs, Canu, Broman-Fulks, Rocheleau, & Nieman, 2012). In one study (Combs et al., 2013), the authors evaluated the contribution of both ADHD and SCT symptoms to quality of life (QOL). Findings indicated that each set of symptoms contributed unique variance to negative QOL ratings, after controlling for the other set of symptoms as well as for anxiety, depression, and some demographic factors. The second study (Combs et al., 2012) found much the same results for the association of ADHD and SCT with self-reported stress in adults. All of the preceding research suggests that SCT is associated with distinct impairments in various domains of functioning from those associated with ADHD and contributes unique effects to impairment beyond that accounted for by ADHD.

Etiology

Very few studies have been done on the etiologies of SCT. A study by Moruzzi, Rijsdijk, and Battaglia (2014) examined the heritability of SCT using a very small set of items. SCT was substantially though moderately heritable, with genetic factors accounting for the majority of variance in symptoms. However, a greater proportion of its variance was attributable to nonshared environmental factors than was the case for ADHD symptoms, which were even more substantially accounted for by genetic factors. And SCT shared about half of its genetic contribution with that of ADHD, implying some shared underlying genetic contributions but some unique to each disorder as well. Given the limited SCT item set, findings might have been different (larger heritability factor) had a longer and hence more reliable SCT scale been employed (because unreliability of measurement is clustered with the nonshared environment estimate).

Several studies observed a link between SCT symptoms and exposure to environmental toxins. One study observed that SCT was associated with prenatal alcohol exposure (Graham et al., 2013). Another noted the association of this symptom dimension with maternal smoking during pregnancy and also secondhand smoke exposure after birth (Camprodon-Rosanas, Ribas-Fitó, et al., 2017). It has also been seen as a treatment-emergent side effect, along with lower IQ and lower academic achievement, in individuals with acute lymphoblastic leukemia (Reeves et al., 2007).

One neuroimaging study has been reported in which SCT symptoms were more strongly associated with abnormal activity in posterior networks related to impaired orienting and shifting of attention, as opposed to abnormalities in frontal–parietal (executive) networks so often evident in ADHD (Fassbender, Krafft, & Schweitzer, 2015). The findings support a degree of differentiation between SCT symptoms and ADHD symptoms in the performance of controlled cognitive activities. Yet one study doesn't make a definitive conclusion here.

And so it seems that, like ADHD, SCT may turn out to have multiple etiologies. Most causes may fall in the realm of neurobiological and genetic factors, perhaps less strongly than does ADHD. We sorely need more research that uses neuroimaging as well as more behavioral genetic and molecular genetic studies on the nature of SCT in comparison to other disorders, especially ADHD. However, researchers must take care to control for the overlap of SCT with ADHD. Not doing so will contaminate any findings with ADHD-related results.

What Is the Underlying Mental Dysfunction in SCT?

We simply do not know. It is possible that SCT represents a dysfunction in the focus/execute component of attention in Mirsky's (1996) model of attention components. It is also possible that SCT is a form of hypersomnia or arousal disorder, given that some dimensions of SCT identified in past research include symptoms of sleepiness, low arousal or energy, or drowsiness (Penny et al., 2009). But this seems unlikely in view of recent evidence in college students that although both SCT and ADHD were significantly associated with daytime sleepiness, sleepiness formed a distinct factor from those representing SCT and ADHD (Langberg, Becker, Dvorsky, & Luebbe, 2014). So SCT is not just another label or proxy for hypersomnia, but it does have a significant association with daytime sleepiness, even after controlling for ADHD, anxiety, and depression symptoms (Langberg, Becker, Dvorsky, & Luebbe, 2014).

Could SCT be a form of pathological mind wandering or maladaptive daydreaming (Adams et al., 2010)? The fact that the only neuroimaging study that linked SCT symptoms to the posterior regions that are implicated in the default mode network, and that this network has a close association with mind wandering (Christoff, Irving, Fox, Spreng, & Andrews-Hanna, 2016), suggests this possibility. Research shows that mind wandering is commonplace and advantageous under certain conditions. It arises when a primary task being performed demands little EF capacity and thus allows the contemplative or problem-solving capacity of the EF system to focus on more salient personal concerns. The latter then becomes a secondary task that is engaged while the individual performs the relatively automatic actions toward familiar goals (primary task) in the environment (Smallwood & Schooler, 2006). When poorly regulated, however, mind wandering can lead to adverse effects when performing EF tasks (perhaps due to reduced meta-awareness or self-monitoring of goal pursuit, diminished WM capacity available for pursing the external goals, etc.) (Smallwood & Schooler, 2006). Excessive mind wandering also can adversely affect academic performance (Smallwood, Fishman, & Schooler, 2007). It would seem to be worthwhile for future research to investigate this possible association of SCT with pathological mind wandering.

There are still other possibilities concerning the underlying nature of SCT. For instance, SCT could arise from a ruminative/obsessional disorder, perhaps being a milder variant of obsessive–compulsive disorder (OCD). Excessive and recurrent focusing on maladaptive thoughts might well lead to an attention problem resembling SCT. The same could be said for the attention problems evident in posttraumatic stress disorder (PTSD). Or SCT could represent a deficit in motivation in which the person lacks not only energy but also initiative or self-motivation. I think that is unlikely, given that research has not linked SCT to deficits in self-motivation, as reflected on EF rating scales by children or adults, once the overlap with ADHD symptoms is statistically removed (Barkley, 2012a, 2013; Becker et al., 2017).

Diagnosing SCT

During the initial evaluation of a child or adult, the suspicion of SCT can arise when there are complaints of inattention in the context of low or no symptoms of hyperactivity or impulsivity and when symptoms of passivity, hypoactivity, and even social withdrawal are evident (Saxbe & Barkley, 2014). Clinicians can then use rating scales that directly assess SCT symptoms (see Barkley, 2011a, for adults and the BSCTS-CA for children) to evaluate the extent to which such symptoms are statistically abnormal relative to population norms, thus revealing the extent of developmental deviance.

There is no official set of diagnostic criteria for SCT. My own research (Barkley, 2013) suggests that if parents endorse at least three or more of the 12 symptoms of SCT on the BSCTS-CA rating scale discussed earlier, and they occur at least "often," this profile would represent the 93rd percentile in the population. That percentile, which is a traditional index of clinical significance and statistical deviance, combined with evidence of impairment from the symptoms, could be used (for the time being) as unofficial diagnostic criteria for SCT in children. It would identify about 5% of the U.S. child population as having this condition.

In the case of an adult, the symptom threshold would be five out of the nine symptoms used in my study of adults (Barkley, 2012a) and reflected on an adult SCT rating scale (Barkley, 2011a). When coupled with evidence of impairment in one or more major life activities, such as may be shown on normed rating scales of impairment (Barkley, 2011b, 2012c), one can make an unofficial diagnosis of SCT.

Treatment of SCT

As with the etiology of SCT, only a few studies have investigated possible treatments for SCT, all in children. Early studies on stimulants (methylphenidate [MPH]) for treating individuals with ADHD inattentive type did not find them to be particularly effective in improving the inattention linked to SCT (Milich et al., 2001), although they were not harmful either. My own study found a modest positive response to MPH, mainly at low doses, but with only 20% of individuals remaining

on this medication after a double-blind, placebo-controlled trial. That low percentage contrasted sharply with the fact that the vast majority of children with ADHD combined type stayed on that medication and their degree of improvement was greater than that of children with ADHD inattentive type, who also showed SCT symptoms (Barkley, DuPaul, & McMurray, 1991). But no stimulant medication studies have been done specifically with individuals with SCT. Even so, recent research (Froehlich et al., in press) reported that higher SCT symptoms predicted a poorer response to MPH, consistent with the earlier studies on ADD–H or the predominantly inattentive type of ADHD.

Only one study to date has examined a nonstimulant ADHD medication for treating SCT symptoms specifically (Wietecha et al., 2013). The researchers found that the norepinephrine reuptake inhibitor *atomoxetine* was effective at reducing SCT symptoms in patients having both ADHD and dyslexia, ADHD only, and dyslexia only. The reduction in SCT symptoms remained evident even after statistically controlling for the overlap of ADHD symptoms and also improved SCT symptoms in the group with dyslexia only (McBurnett et al., 2017).

What other medications might work to treat SCT? Given its overlap with anxiety and depression, perhaps selective serotonin reuptake inhibitors (SSRIs) could be a possible treatment. Would an activating antidepressant (e.g., fluoxetine, sertraline, venlafaxine, or bupropion) reduce the observed sluggishness and boost alertness? Some clinicians have used Luvox (fluvoxamine, which functions as an SSRI) for management of pathological mind wandering, given its effects on obsessional thinking, but it is not clear that such thinking is the case in SCT. Given that SCT is associated with hypersomnia or daytime sleepiness, should one consider investigating the use of anti-narcoleptics, such as Modafinil? It seems to me that the alpha-2 agonist guanfacine XR, used for management of ADHD, might be worth investigating for SCT, but its side effects of sleepiness could be counterproductive in view of the sluggish/sleepy features seen in SCT. There is great opportunity for research here to explore possible medications for the management of this condition.

Just two studies of behavior modification methods have been conducted to date, and these were done with individuals with predominantly inattentive ADHD, many of whom had SCT. The results indicated a good response of children with SCT symptoms to traditional home and school behavior management methods when targeted to the specific symptoms of SCT (Pfiffner et al., 2007). Although it did not use SCT cases specifically, one study of social skills training found that children with ADHD inattention type (who are more likely to have SCT) improved more in their assertion skills than did those with ADHD combined type (Antshel & Remer, 2003). Yet no children with either type of ADHD improved in other domains of social skills. Cognitive-behavioral therapy (CBT) has not been shown to be useful for ADHD (Abikoff, 1985), but it has proven useful for cases of anxiety and/or depression (Cuijpers, Berking, Andersson, Quigley, Kleiboer, & Dobson, 2013). I believe it may be worth exploring as a possible intervention for SCT, given the higher-than-expected comorbidity between these disorders. In view of the distinct symptoms and impairments of SCT relative to ADHD, treatments for ADHD cannot be automatically assumed to work for SCT nor can those treatments that have failed for ADHD be thus ruled out for SCT.

Conclusions

- SCT is an impairment of attention in daydreamy, hypoactive-appearing individuals, which first presents in childhood. It is characterized by a cognitive dimension of symptoms, comprising daydreaming, sleepiness, staring, "spaciness," and mental fogginess and confusion, along with a motor dimension of slow movement, hypoactivity, lethargy, and passivity.
- The symptom dimensions forming SCT are distinct from, yet partially correlated with, those forming ADHD, especially its inattention dimension.
- To avoid giving offense to patients having the condition and their families, as well as to avoid implying that the cognitive deficit in SCT is known, the condition should be called by a more benign label, such as CDD.
- The history of SCT in the medical literature probably dates back to Alexander Crichton in 1798 or, at the very least, to 1984, as found in research exploring the validity of ADD–H created in DSM-III.
- At this time SCT exists only as a research entity that has yet to debut in diagnostic literature.
- SCT is associated with significant impairment, most reliably in social impairment, primarily social withdrawal. It also makes some contribution to difficulties with academic performance in children, and by adulthood even more so. In adults it is associated with impairment in occupational functioning.
- SCT is significantly associated with risk for internalizing symptoms, especially depression, and likely anxiety as well.
- It has no, or even a negative, relationship to ODD (and hence likely has no, or even a negative, relationship to conduct disorder, substance use disorders, or antisocial personality disorder).
- The etiologies of SCT are not well studied, but some evidence suggests a strong heritability to the disorder, though not as much as is seen in ADHD. SCT may also be associated with fetal alcohol exposure and with the treatment of acute lymphoblastic leukemia. Perhaps abnormal activity in the brain's default mode network may be linked to SCT, as one study suggests.
- Evidence supports the view that SCT is distinct from ADHD and not a subtype of it, but the two conditions can overlap in nearly half of all cases of each.
- Future diagnostic taxonomies, such as the DSM, should create a higher-order category of attention disorders under which one would then break out ADHD and SCT as separate, semidistinct conditions, much like what is done now for the supracategory of learning disabilities (LDs), rather than continue the mistaken view that SCT is a subtype of ADHD.
- Very little research has been done on treatments for SCT, so no conclusions concerning its management can be made at this time.

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