

The Internal, External, and Diagnostic Validity of Sluggish Cognitive Tempo: A Meta-Analysis and Critical Review

Stephen P. Becker, PhD, Daniel R. Leopold, MA, G. Leonard Burns, PhD, Matthew A. Jarrett, PhD,
Joshua M. Langberg, PhD, Stephen A. Marshall, MS, Keith McBurnett, PhD,
Daniel A. Waschbusch, PhD, Erik G. Willcutt, PhD

Objective: To conduct the first meta-analysis evaluating the internal and external validity of the sluggish cognitive tempo (SCT) construct as related to or distinct from attention-deficit/hyperactivity disorder (ADHD) and as associated with functional impairment and neuropsychological functioning.

Method: Electronic databases were searched through September 2015 for studies examining the factor structure and/or correlates of SCT in children or adults. The search procedures identified 73 papers. The core SCT behaviors included across studies, as well as factor loadings and reliability estimates, were reviewed to evaluate internal validity. Pooled correlation effect sizes using random effects models were used to evaluate SCT in relation to external validity domains (i.e., demographics, other psychopathologies, functional impairment, and neuropsychological functioning).

Results: Strong support was found for the internal validity of the SCT construct. Specifically, across factor analytic studies including more than 19,000 individuals, 13 SCT items loaded consistently on an SCT factor as opposed to an ADHD factor. Findings also support the reliability (i.e., internal consistency, test-retest reliability, interrater reliability) of SCT. In terms of external validity, there is some indication that SCT may increase with age ($r = 0.11$) and be associated with lower socioeconomic status ($r = 0.10$). Modest (potentially negligible) support

was found for SCT symptoms being higher in males than females in children ($r = 0.05$) but not in adults. SCT is more strongly associated with ADHD inattention ($r = 0.63$ in children, $r = 0.72$ in adults) than with ADHD hyperactivity-impulsivity ($r = 0.32$ in children, $r = 0.46$ in adults), and it likewise appears that SCT is more strongly associated with internalizing symptoms than with externalizing symptoms. SCT is associated with significant global, social, and academic impairment ($r = 0.38$ – 0.44). Effects for neuropsychological functioning are mixed, although there is initial support for SCT being associated with processing speed, sustained attention, and meta-cognitive deficits.

Conclusion: This meta-analytic review provides strong support for the internal validity of SCT and preliminary support for the external validity of SCT. In terms of diagnostic validity, there is currently not enough evidence to describe SCT in diagnostic terms. Key directions for future research are discussed, including evaluating the conceptualization of SCT as a transdiagnostic construct and the need for longitudinal research.

Key words: attention-deficit/hyperactivity disorder, diagnosis, nosology, sluggish cognitive tempo, systematic review

J Am Acad Child Adolesc Psychiatry 2016;55(3):163–178.

Although sluggish cognitive tempo (SCT) has been studied in child and adolescent psychiatry and psychology since the mid-1980s, the last 15 years have witnessed a marked increase in interest in examining and understanding the SCT construct.¹ Although SCT was initially evaluated as a possible way to identify children with a “pure” attention-deficit/hyperactivity disorder (ADHD) predominantly inattentive type (ADHD-I),² research has not convincingly supported this possibility and has increasingly turned to examining SCT in its own right.¹ This growing

body of research has primarily focused on evaluating the internal and external validity of SCT. That is, research on SCT has so far been primarily concerned with 2 questions: whether SCT symptoms are empirically distinct from other psychopathology symptoms and reliable (i.e., internal validity); and whether SCT symptoms are associated with demographic characteristics, other psychopathology symptoms, functional impairments, and/or cognitive or neuropsychological functioning (i.e., external validity).

As the body of research examining the internal and external validity of SCT has grown, it has been argued that SCT may be its own psychiatric disorder.^{3,4} However, the proposal for a new psychiatric disorder comes with important responsibilities and should be approached with caution given the far-reaching implications for diagnostic nosology, public perceptions of psychiatry and psychology, public health, and potential to pathologize nonpsychopathological behaviors. With these considerations in mind, the goals of



This article is discussed in an editorial by Dr. Russell A. Barkley on page 157.



Supplemental material cited in this article is available online.

this meta-analytic and critical review are 3-fold. First, a meta-analysis of the internal validity of SCT was undertaken to empirically evaluate the specific set of items/behaviors that best measures the SCT construct, the distinctiveness of SCT from ADHD and other psychopathologies (e.g., depression, anxiety), and the reliability (i.e., internal consistency, test-retest, and interrater reliability) of SCT. Second, a meta-analysis of the external validity of SCT was conducted to evaluate whether SCT is uniquely associated with demographics, other psychopathologies, functional impairments, and/or cognitive/neuropsychological functioning. Third, the meta-analytic findings are discussed in light of the 8 domains outlined by Cantwell⁵ (modified from Robins and Guze⁶) that together provide a framework for determining the diagnostic validity of a construct. Finally, we offer important directions for future research tied directly to these 8 diagnostic validity criteria, with specific attention to those domains for which extant studies offer mixed results or for which empirical data are as yet unavailable. Taken together, this study synthesizes and integrates the literature regarding the internal, external, and diagnostic validity of the SCT construct while also highlighting important directions for future research.

METHOD

Literature Search

A comprehensive search of the relevant literature was completed to identify all studies published in English that included data relevant to the internal or external validity of SCT. Because the SCT construct was first introduced in the mid-1980s,⁷ computer searches were performed for the dates January 1985 through September 2015 in the PubMed, PsycINFO, and Web of Science databases (see Supplement 1, including Figure S1, available online, for additional detail regarding the search procedures). Only peer-reviewed publications were included, since it was determined that some typical indices of study quality do not readily apply to the current state of SCT research (see Supplement 1, available online, for additional information). The search procedures identified 73 papers, including 61 papers based on 54 independent samples of children and adolescents, and 12 papers based on 10 independent samples of adults. To facilitate the evaluation of the validity of SCT across the developmental spectrum, studies of children and adolescents (defined as 17 years of age or younger) and studies of adults (18 years of age and older) were examined separately.

Meta-Analysis

To provide a comprehensive summary of the literature, meta-analyses were completed for each criterion measure if at least 2 studies used designs and measures that addressed the internal and/or external validity of SCT (e.g., psychometric characteristics of SCT measures and analyses of the relation between SCT and functional impairment, other psychopathology symptoms, and neuropsychological functioning). In addition to summarizing the meta-analytic results, we also provide a brief qualitative summary of relevant issues that were unable to be examined meta-analytically (e.g., the relation between SCT and impairment after controlling for ADHD).

Summary Statistics. Pooled effect sizes were calculated using the Comprehensive Meta-Analysis statistical package.⁸ Because most studies reported results of correlational analyses of continuous measures of SCT, all other effect sizes were converted to

Pearson correlations (r). If a study reported more than 1 effect size that was relevant for a particular analysis (for example, 2 different measures of anxiety), a single effect size was computed using the procedure described by Gleser and Olkin.⁹ To minimize the impact of any heterogeneity among effect sizes due to systematic differences in study populations, experimental design, measures, or other study procedures, effect sizes were estimated using a random effects model¹⁰ (see Supplement 1, available online, for additional details).

Summary statistics from the meta-analyses are described in the text and tables included in the main article. Parallel tables in the supplemental materials (available online) list the individual effect sizes that were included in the meta-analysis that yielded each pooled effect size. The supplemental tables (available online) also provide a summary of analyses conducted to test for evidence of publication bias or significant heterogeneity among the effects.

Measurement of SCT: The Universe of SCT Items

In contrast to reviews of the internal validity of clearly defined diagnostic constructs such as the *DSM-IV* symptom dimensions of ADHD,¹¹ a systematic evaluation of the measurement of SCT is complicated by the fact that there is currently no consensus regarding the core constructs that should be included in a comprehensive definition of SCT. Furthermore, even when there is general agreement regarding an overarching construct that should be included, the operational definition of the constructs has often varied dramatically across studies. Therefore, to set the stage for this comprehensive review of the validity of SCT as a construct, we first systematically examined the specific items that have been used to measure SCT in previous studies.

To synthesize these complex data, all items included in measures of SCT in previous studies were coded to indicate the core domain/construct that was assessed by the item. If a single item assessed multiple domains/constructs that could potentially be independent indicators of SCT (e.g., a widely used item asked whether the individual is “underactive, slow moving, or lacks energy”), the item was included in the list for each of the domains/constructs (see Supplement 1, available online, for more detail). Despite the variability in the specific wording of items across studies, this initial examination of item content suggested that the overall pool of 150 items was intended to measure a smaller set of 18 core features that may potentially characterize SCT. Table 1 lists each of these core behaviors and the number of studies that included at least 1 item that assessed each domain/construct; Table S1, available online, provides a comprehensive list of the coding decisions for all potential SCT items used in previous studies. No study included in the current review measured all 18 SCT domains/constructs, but nearly all studies included at least 1 item that measured the tendency to daydream (65 of 73 studies), and several other items were included in more than half of the studies (Table 1). In contrast, items assessing apathetic behavior, low motivation, and the tendency to become easily bored were included only in a minority of studies.

RESULTS

Internal Validity

As a first step to assess the validity of SCT as a construct, SCT must be shown to have adequate internal validity. In this section, we review studies that included SCT items in factor analytic studies and then summarize results of studies that examined the internal consistency, interrater reliability, and short-term and long-term stability of SCT.

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