THE FACTS: ADHD AND SLUGGISH COGNITIVE TEMPO (SCT)

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Learning Objectives

- To define what SCT is and how it relates to ADHD
- To understand how SCT relates to other symptoms and impairments and whether SCT should be viewed as a separate disorder
- To describe possible avenues for treating SCT symptoms

My Background

- Duke ADHD Research Program
  - Follow-up phase of the MTA Study
  - Brain imaging study of parent-child dyads with ADHD
- Graduate work at Virginia Tech
  - Developed research program on ADHD and anxiety co-occurrence and these disorders individually
- 2010-2018
  - Associate Professor, Director of Clinical Training, Department of Psychology
  - Director, Child and Adolescent Anxiety Clinic
  - Research lab examines ADHD, anxiety, and related disorders in youth, adolescents, and emerging adults
  - Growing interest in SCT

History of SCT

- Cluster of symptoms first identified in the mid-1980s
  - Initially thought to be associated with the Predominantly Inattentive Type of ADHD (ADHD-I)
- More recent studies have found a similar level of prevalence across the subtypes/presentations
- Interest in SCT reignited within the past decade
- Questions about diagnostic validity
  - https://www.nytimes.com/2014/04/12/health/idea-of-new-attention-disorder-spurs-research-and-debate.html

What is SCT?

- A set of cognitive and behavioral symptoms that commonly co-occur with ADHD
  - Daydreams
  - Sleepy/drowsy
  - Underactive/slow moving
  - Easily confused
  - Stares blankly
  - Lost in thoughts
  - In a fog
  - Spacey
  - Sluggish
- Challenge
  - Inconsistent measurement and item set
    - Hard to agree on what SCT reflects and even what it should be called given that it is not currently operationalized in manuals such as the *DSM*

SCT Item Set (Becker et al., 2016)

TABLE 1 Core Behaviors of the Sluggish Cognitive Tempo (SCT) Construct and Frequency of Inclusion Across Studies

SCT Construct	Studies Including at Least 1 Item From the SCT Construct, n
Daydreams	64
Sleepy/drowsy	49
Underactive/slow moving	49
Easily confused	47
Stares blankly	45
Lost in thoughts	43
In a fog	38
Tired/lethargic	35
Sluggish	33
Spacey/alertness changes from moment to moment	29
Slow thinking and responding	26
Apathetic/unmotivated	20
Low initiative and persistence	17
Absentminded	15
Easily bored	14
Slow work/task completion	18
Loses train of thought/loses cognitive set	12
Poor listening/difficulty with directions	5

Note: A total of 73 studies were identified by the literature search. See Table S1, available online, for a full list of all items that were included as measures of each construct.

Is SCT Distinct from ADHD?

- Becker et al. (2016)
  - Meta-analysis examining the internal and external validity of SCT
  - Are SCT symptoms statistically distinct from ADHD Symptoms?
    - Yes (but highly correlated with ADHD inattention symptoms)
    - This has been replicated in over 20 studies
    - Also distinct from internalizing problems and daytime sleepiness
- Does SCT have diagnostic validity?
  - This is a more complex question…

Cantwell Criteria (1995)

- Clinical Phenomenology
- Demographic Factors
- Psychosocial Factors
- Biological Factors
- Family Genetic Factors
- Family Environment Factors
- Natural History
- Intervention Response

Clinical Phenomenology? Yes.

- SCT is distinct from ADHD and other symptom domains
  - Distinct from ADHD inattention
  - Distinct from general disruptive behavior
- Strongly associated with internalizing problems (particularly depression) even after controlling for ADHD inattention
- Non-significant or even negative correlation with externalizing problems
- Significantly related to sleep problems
- Need for more studies outside of ADHD (e.g., anxious or depressed samples)
- Associations with neuropsychological functioning unclear (most likely sustained attention and processing speed)

Clinical Phenomenology: 13 Recommended Items

Item Content
Sluggish‡
Tired/lethargic‡
Slow thinking/processing‡
Loses train of thought/cognitive set‡
Sleepy/drowsy‡
Spacey‡
In a fog‡
Underactive/slow moving‡
Daydreams‡
Lost in thoughts‡
Stares blankly‡
Easily confused‡
Apathetic/unmotivated‡

Demographic Factors? Somewhat.

- Unassociated with race/ethnicity
- Somewhat more likely to be older and female
- Increase in SCT symptoms over time? Similar to depression onset?
- Some evidence for relations to lower SES, lower parent education, and lower family income
  - Inconsistent evidence though

Psychosocial Factors? Very limited.

- Psychosocial stress?
- What about other areas such as family functioning or trauma exposure?
- More studies needed….

Biological Factors? Very limited

- This was a notable gap in the review
- One study examining brain imaging and SCT
  - Hypoactivity in the left superior parietal lobe during a cued Flanker task
  - Difficulty with attention orienting or shifting?
- Does SCT involve a different attentional network?
- Problems with arousal?
- Recent evidence that while ADHD is highly correlated with lower frontal EEG activity, SCT is not correlated with a lack of activity in this area (Jarrett et al., 2017)

Biological Factors (Jarrett et al., 2017)

	1	2	3	4	5	6	7	8	9	10
1. TBR Frontal	1									
2. TBR Frontal Central	**.93**	1								
3. TBR Central	**.81**	**.93**	1							
4. TBR Parietal	**.60**	**.76**	**.60**	1						
5. TBR Parietal Central	**.67**	**.82**	**.96**	**.98**	1					
6. CBCL Attention Problems	.15	.21	.18	.21	.23	1				
7. ADHD Symptom Group	**.33**	**.36**	*.29*	*.28*	*.29*	**.88**	1			
8. SCT	.01	.05	.12	.18	.19	**.77**	**.58**	1		
9. Hit RT	.25	*.28*	*.29*	.17	.18	–.01	–.02	–.05	1	
10. Hit RT Standard Error	.26	**.34**	**.37**	**.38**	**.37**	**.54**	**.52**	**.45**	**.52**	1
11. Commissions	–.25	–.25	–.25	–.10	–.25	**.39**	**.34**	**.41**	**–.70**	.04

Family Genetic Factors? Very limited.

- Only two twin studies that have examined heritability
- Both studies found SCT to be significantly heritable
  - 1/3 to 2/3 of variance accounted for by genetics
  - Less heritable than ADHD symptoms
- More studies needed on the genetics of SCT…

Family Environmental Factors? Very limited.

- Only two twin studies that have examined heritability
- Some evidence for shared and nonshared environmental factors
- More research needed on the potential of environmental factors

Natural History? Somewhat.

- Natural history as the untreated outcome of SCT
- Associated with global, social, and academic impairment
- Remains associated with impairment even after controlling for different symptoms domains
- Seems to be a particularly strong link with social withdrawal
  - Again, similar to depression
- Very few longitudinal studies…

Treatment Response? Very Limited.

- No intervention has been designed specifically for SCT
- Some evidence for a home-school intervention with kids with ADHD-I showing changes on SCT (large effect size; Pfiffner et al., 2007)
- One study has examined medication effects and found evidence for atomoxetine improving SCT (Wietecha et al., 2013)
- One study found that SCT does not affect methylphenidate response (Ludwig et al., 2009)
- What about approaches such as CBT that are effective for problems like depression? Physical activity? Mindfulness?
- Sleep interventions?
- Could SCT inform psychopharmacological interventions? Enhanced atomoxetine response?

Diagnostic Validity? (Becker et al., 2016)

- Clinical Phenomenology? Yes.
- Demographic Factors? Somewhat.
- Psychosocial Factors? Very limited.
- Biological Factors? Very limited
- Family Genetic Factors? Very limited.
- Family Environmental Factors? Very limited.
- Natural History? Somewhat.
- Treatment Response? Very Limited.
- Our conclusion: It's too early.

Recommendations (Becker et al., 2016)

- More longitudinal research regarding SCT
- More research in samples other than ADHD
- Additional measures such as laboratory tasks, biological measures, etc.
- Need to refine the symptom set so we can agree on a common set of symptoms
  - Who are the best informants?
- Although there is evidence for the statistical distinctiveness of SCT, is there clinical distinctiveness? Can we reliably differentiate SCT from those with ADHD, depression, anxiety, and sleep difficulties?

Current Research on SCT

- Stephen Becker, Cincinnati Children's Hospital and Medical Center
  - Grants examining sleep intervention for SCT and how sleep and SCT relate to academic impairment
  - https://ies.ed.gov/funding/grantsearch/details.asp?ID=1787
  - https://projectreporter.nih.gov/project_info_description.cfm?aid=9265963&icde=37789706&ddparam=&ddvalue=&ddsub=&cr=2&csb=default&cs=ASC&pball=
- Our lab
  - Pilot work examining SCT and mindfulness intervention
  - Student projects examining physical activity and differences between those with ADHD and ADHD + SCT

Thesis Project: Ana Rondon (*Journal of Attention Disorders*, in press)

Table 1. Group Differences on Symptomatology

CBCL	**ADHD (*n* = 108)**	**ADHD+SCT (*n* = 34)**	**SCT (*n* = 21)**	**F**	***df***	***p***	**η_p^2 or η^2**
Attention Problems	67.59 (7.78)[a]	78.18 (7.89)[b]	75.24 (7.78)[b]	27.70	2, 160	< **.01**	.26
Attention Problems*	7.47 (2.68)[a]	9.30 (2.34)[b]	6.90 (2.57)[a]	7.28	2, 151	< **.01**	.09
Internalizing Problems	59.04 (10.08)[a]	66.97 (10.22)[b]	72.95 (8.41)[b]	21.72	2, 160	< **.01**	.21
Anxious/Depressed	60.01 (8.21)[a]	65.68 (10.51)[b]	71.38 (11.64)[b]	15.71	2, 160	< **.01**	.16
Withdrawn/Depressed	57.33 (7.31)[a]	65.32 (9.57)[b]	70.24 (7.51)[b]	31.29	2, 160	< **.01**	.28
Externalizing Problems	60.71 (10.77)[a]	64.50 (9.30)	67.10 (9.18)[b]	4.34	2, 160	**.02**	.05
Rule Breaking behavior	59.45 (8.64)	61.50 (9.36)	63.10 (8.24)	1.90	2, 160	.15	.02
Aggressive behavior	62.67 (10.46)[a]	65.50 (10.38)	69.57 (11.26)[b]	4.12	2, 160	**.02**	.05
Social Problems	60.66 (9.51)[a]	62.59 (7.27)	67.10 (11.55)[b]	4.26	2, 160	**.02**	.05
Additional CBCL	**ADHD (*n* = 107)**	**ADHD+SCT (*n* = 33)**	**SCT (*n* = 19)**	**F**	***df***	***p***	**η_p^2**
Sleep Problems	1.93 (2.13)[a]	3.12 (2.56)[b]	4.11 (2.69)[b]	9.06	2, 154	< **.01**	.11
Additional CBCL	**ADHD (*n* = 105)**	**ADHD+SCT (*n* = 33)**	**SCT (*n* = 22)**	**F**	***df***	***p***	**η_p^2**
Social Withdrawal	1.30 (1.40)[a]	2.39 (1.71)[b]	3.27 (2.07)[b]	14.59	2, 155	< **.01**	.16
TRF	**ADHD (*n* = 87)**	**ADHD+SCT (*n* = 26)**	**SCT (*n* =17)**	**F or H**	***df***	***p***	**η^2**
Attention Problems	64.00 (8.11)	64.65 (7.85)	59.18 (7.27)	2.95	2, 127	.06	.04
Internalizing Problems	57.16 (10.23)	55.92 (8.10)	50.65 (10.86)	3.06	2, 127	.05	.05
Externalizing Problems	59.51 (9.97)	56.62 (7.63)	54.00 (12.91)	2.57	2, 127	.08	.04
Social Problems	60.26 (9.02)	57.62 (5.50)	55.47 (7.38)	5.52	2	.06	.04
MASC	**ADHD (*n* = 79)**	**ADHD+SCT (*n* = 24)**	**SCT (*n* = 16)**	**F**	***df***	***p***	**η^2**
Total Anxiety	50.91 (15.05)	49.75 (13.01)	46.75 (11.54)	.58	2, 116	.56	.01
CDI	**ADHD (*n* = 85)**	**ADHD+SCT (*n* = 24)**	**SCT (*n* = 17)**	**F**	***df***	***p***	**η^2**
Total Depression	51.54 (11.09)	48.63 (11.67)	48.18 (7.30)	1.15	2, 123	.32	.02

Mindfulness Study (8-Week Group for College Students with ADHD)

Measure	Pre	Post-WL	Post	Pre vs. Post-WL *d*	Post WL vs. Post *d*
BAARS Inattention	29.80 (1.64)	26.00 (5.70)	25.20 (4.09)	.91	.16
BAARS Hyperactivity	10.40 (1.95)	10.00 (1.22)	10.80 (2.49)	.25	-.41
BAARS Impulsivity	10.40 (2.07)	9.60 (2.88)	9.40 (3.58)	.32	.06
BAARS SCT	27.20 (4.15)	24.20(3.42)	20.20 (2.77)	.79	**1.29**
CAARS Inattention	27.40 (1.14)	25.00 (6.93)	21.25 (5.68)	.48	.59
CAARS H/I	21.20 (9.58)	19.00 (7.71)	16.25 (10.40)	.25	.30
BAI Total Score	8.40 (5.18)	10.80 (7.95)	3.50 (1.91)	-.36	**1.26**
BDI Total Score	8.80 (5.45)	6.20 (6.38)	3.75 (4.35)	.44	.45
DERS Total Score	77.60 (21.22)	73.80 (15.77)	63.50 (4.20)	.20	**.89**
BFIS Total Score	5.76 (1.26)	4.46 (2.63)	3.52 (1.55)	.63	.44

References

- Becker et al. (2016)
  - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4764798/
- New York Times article
  - https://www.nytimes.com/2014/04/12/health/idea-of-new-attention-disorder-spurs-research-and-debate.html
- Jarrett et al. (2017)
  - https://www.ncbi.nlm.nih.gov/pubmed/28800715