LOG ID	BOOK REFERENCE	RCT FILTER	CONFIDENCE TIER
SEC 10.1.2	CHAPTER 10: HARDENED INFRASTRUCTURE (Chaos Engineering)	OFF	CONSENSUS

AUDITED CLAIM

NEURODIVERGENT ACCESSIBILITY (ADHD SENSORY REGULATION)

SYSTEMS MODEL — AS STATED IN THE BOOK

> Clinically, for many neurodivergent phenotypes, concurrent external **sensory stimulation** is not a "distraction"; it acts as a necessary compensatory aid to regulate baseline **autonomic arousal** and support executive functioning.

VALIDATION QUERY

Do individuals with ADHD rely on concurrent external sensory stimulation to regulate baseline nervous system function and support executive functioning?

EMPIRICAL FINDING

A robust body of neurodivergent research establishes that ADHD is frequently associated with atypical sensory processing and altered autonomic arousal, often trending toward hypo-arousal. For a meaningful subset of neurodivergent individuals, concurrent external sensory stimulation (such as background noise) is not a distraction, but a valid compensatory aid used to regulate baseline nervous system arousal and improve executive functioning.

PRIMARY ANCHORS

→ **Jurek et al., 2025, Journal of the American Academy of Child and Adolescent Psychiatry**

→ **Bellato et al., 2019, Neuroscience and Biobehavioral Reviews**

ABOUT THIS RECORD

Each claim in the book is decompiled from its IT metaphor into a naked, falsifiable scientific claim, then anchored to a **primary peer-reviewed source**. Claim and anchor are queried against the Consensus academic database (200M+ papers) under a fixed protocol — top-tier **Q1/Q2 journals only**, preprints excluded, human studies only. If a hypothesis fails the audit, the build is rejected: the AI generates the syntax; the peer-reviewed grid validates the physics.

CONFIDENCE TIERS

- **CONSENSUS ◀ this log** — broadly established, highly replicated mechanics.
- **EMERGING** — plausible, actively researched; no universal consensus yet.
- **EXPERIMENTAL** — contested, extrapolated, or purely theoretical.

RCT FILTER — Controlled Studies is ON for interventions (a forced action must beat a control) and OFF for mechanisms (so foundational neuroscience isn't blocked).

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Yes, **some individuals with ADHD benefit** from **external sensory stimulation**, but it is **not a universal reliance**.

1. Introduction

ADHD appears to involve atypical arousal regulation and atypical sensory processing in at least a substantial subset of individuals, and both are plausibly linked to executive dysfunction. A systematic review of 55 autonomic studies found ADHD-related ANS dysfunction more often in the direction of hypo-arousal than hyperarousal, especially at rest and during response-regulation or sustained-attention tasks, although almost half of findings were null (Bellato et al., 2019). A 2025 meta-analysis of 30 studies found ADHD was associated with higher sensory sensitivity, sensory avoidance, low registration, and sensory seeking than controls, but heterogeneity was high and only 9 studies had overall low risk of bias (Jurek et al., 2025). Large imaging reviews also place ADHD abnormalities in attention, executive-control, visual, and sensorimotor networks rather than in a single “sensory regulation” pathway (Cortese et al., 2012; Kowalczyk et al., 2021).

Experimental work suggests that added stimulation can improve performance under some conditions. White noise reduced omission errors in children with ADHD and was linked to greater benefit in those with weaker vigilance and inhibition (Baijot et al., 2016). Preschoolers with ADHD also showed better detectability, fewer omissions, and less hyperactive behavior under white noise, while typically developing peers worsened (Lin, 2022). Verbal working memory was best under white noise and worst in silence in one pilot ADHD sample, with the opposite pattern in controls (Chen et al., 2022). At the same time, evidence from brain stimulation and sensory-device trials is mixed, and some larger controlled studies fail to show clear executive or symptom benefits (Ornella et al., 2023; Ostinelli et al., 2025; Conti et al., 2026).

Do individuals with ADHD rely on concurrent external sensory stimulation to regulate baseline nervous system function and support executive functioning?
Requires at least 5 papers that directly answer your question. Try adjusting your query to find more papers.

FIGURE 1 Research consensus on sensory stimulation in ADHD

The literature supports a qualified yes: external stimulation often helps a subset of people with ADHD, especially on attention or inhibition tasks, but current evidence does not show that people with ADHD generally require concurrent stimulation to regulate baseline nervous-system function (Bellato et al., 2019; Baijot et al., 2016; Conti et al., 2026).

2. Methods

This Deep Search synthesis was built from a structured search over more than 170 million research papers indexed in Consensus, drawing on Semantic Scholar, PubMed, and other scientific sources. The workflow identified 962,988 papers in the main search, expanded through targeted alternate-term, contrastive, and interdisciplinary searches, screened 240 machine-filtered papers, retained 138 after relevance filtering and deduplication, and included the top 50 most relevant papers for full synthesis.

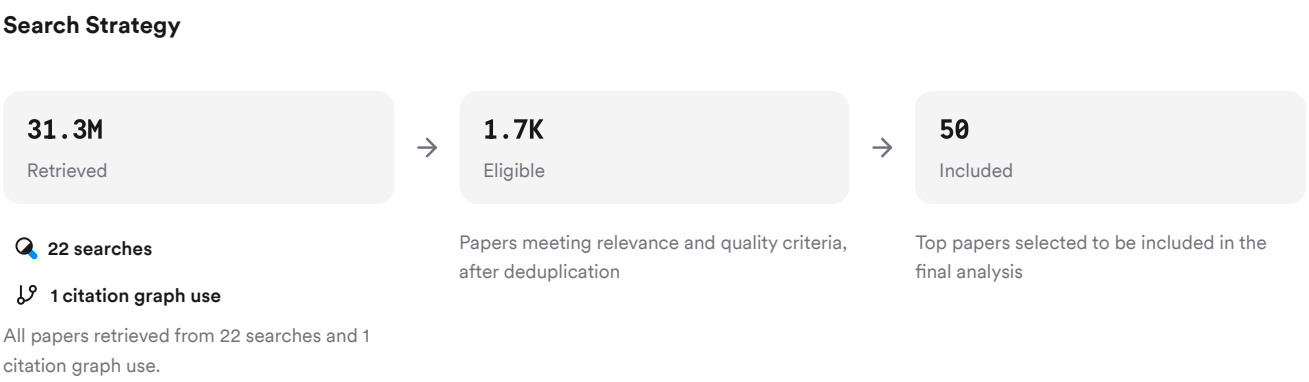

FIGURE 2 Search and screening flow for included papers

The strategy combined theory, intervention, sensory-processing, autonomic-arousal, and ecological-intervention searches to capture supportive and contradictory evidence.

3. Results

3.1 Key Papers

The strongest anchor papers are the systematic reviews and meta-analyses on autonomic arousal, sensory processing, and stimulation-based interventions, because they summarize the broadest evidence base and define the main uncertainty. Key experimental anchors are the white-noise studies and recent neuromodulation trials, which test whether added stimulation can acutely improve executive performance or symptoms (Bellato et al., 2019; Jurek et al., 2025; Salehinejad et al., 2019).

Paper	Summary
(Micoulaud-Franchi et al., 2019)	Hypo-arousal appears common, but null findings are frequent (Bellato et al., 2019)
(Schulze et al., 2021)	ADHD shows broad sensory atypicalities across domains (Jurek et al., 2025)
(Peng et al., 2023)	White noise improved omission errors in ADHD (Baijot et al., 2016)

FIGURE 3 Foundational papers anchoring this literature

3.2 Sensory-Arousal Models

Several papers explicitly argue that sensory seeking and benefit from external stimulation can reflect compensation for reduced baseline arousal. A 2024 study states that children with ADHD may show reduced sympathetic activation, high sensory thresholds, and impaired executive functions, and that salient sensory input may sustain arousal while hyperactivity may act as compensation (Huang et al., 2024). The same paper reports that sensory seeking predicted inhibitory function in ADHD and frames this within LC-NE dysfunction and compensatory stimulation-seeking (Huang et al., 2024). A 2024 review similarly argues that ADHD involves interactions between executive dysfunction and arousal dysregulation, with LC-mediated norepinephrine signaling affecting perception, working memory, and sustained attention (Isaac et al., 2024).

This model is plausible but not settled. The autonomic review found more evidence for hypo-arousal than hyperarousal, yet nearly half of reported findings were null (Bellato et al., 2019). Longitudinal data also complicate a simple compensation story: larger phasic alerting effects predicted higher ADHD symptoms two years later, rather than clearly better outcomes (Kleberg et al., 2023).

3.3 White Noise and Concurrent Stimulation

Dimension	White Noise	Peripheral Visual Stimulation	Citations
Population	Children, preschoolers	Adults	(Baijot et al., 2016; Richter et al., 2023)
Task benefit	Fewer omissions, better detectability	Better CPT detectability, fewer commissions	(Baijot et al., 2016; Lin, 2022; Richter et al., 2023)
Executive domain	Vigilance, inhibition, verbal WM	Metacognition, inhibition	(Baijot et al., 2016; Chen et al., 2022; Richter et al., 2023)
Control comparison	TD children often worsened	Open-label, no sham control	(Lin, 2022; Richter et al., 2023)
Mechanistic interpretation	Arousal regulation models	Added arousal / signal boosting	(Baijot et al., 2016; Richter et al., 2023)

FIGURE 4 Concurrent stimulation paradigms tested in ADHD

These studies support condition-dependent facilitation, not a universal need for stimulation. Benefits are clearest in tasks tapping vigilance, omission control, or verbal working memory, and often in participants with weaker baseline cognitive control (Baijot et al., 2016). The strongest caveat is that some evidence is open-label or pilot-scale, and mechanisms remain debated (Richter et al., 2023; Rijmen & Wiersema, 2024).

3.4 Sensory Processing and Executive Function

Sensory processing differences and executive dysfunction are consistently associated in ADHD, but association is not the same as dependence on external stimulation. In 228 children with ADHD, sensory-integration measures correlated with ADHD symptoms and rating-based executive-function measures, and working memory fully mediated links between several sensory domains and inattention (Li et al., 2022). Another 2024 study found positive associations between sensory processing, executive function, and behavior, with executive function mediating sensory-behavior links (Owen et al., 2024). In adults with ADHD, poorer sensory gating related to lower P300 amplitude, supporting a link between deficient filtering of irrelevant input and weaker higher-order attentional or executive processing (Micoulaud-Franchi et al., 2019).

Other sensory findings point to vulnerability as much as benefit. Adults with ADHD show auditory hypersensitivity, crossmodal overactivation, and altered multisensory integration, which could increase distractibility rather than support control (Schramm et al., 2023; Schulze et al., 2021).

Results Timeline

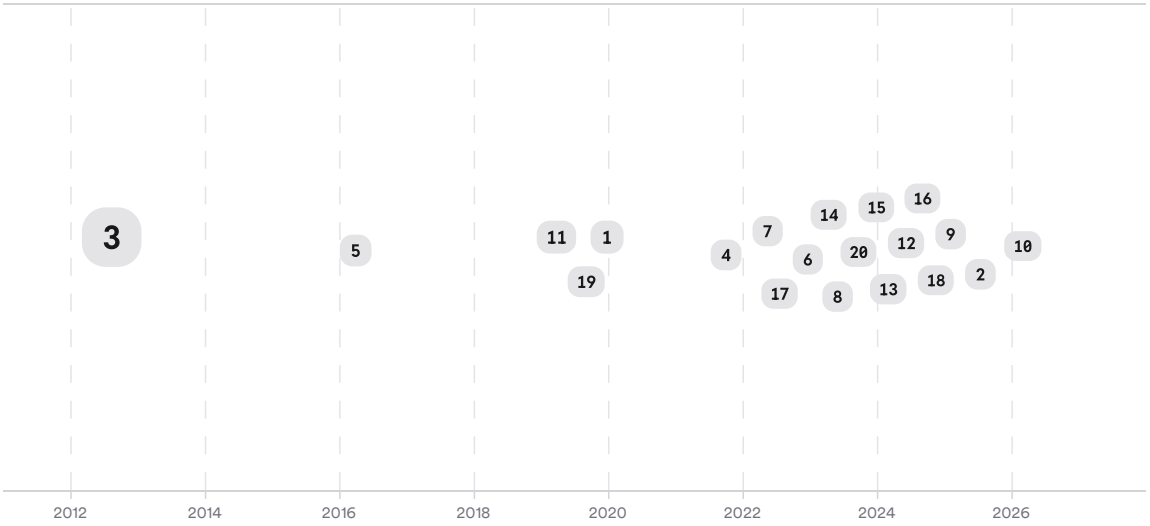

FIGURE 5 Timeline of ADHD stimulation and sensory research; larger markers indicate more citations

The arc runs from broad neural-network models of ADHD, to arousal and sensory-processing frameworks, to targeted experimental stimulation studies. More recent work increasingly tests moderators and mechanism, but large confirmatory trials still often soften early enthusiasm (Cortese et al., 2012; Jurek et al., 2025; Conti et al., 2026).

Top Contributors

Type	Name	Papers
Author	K. Rubia	[1afbb290b3445f228f78d607c27b4c71][44631d879b9c558da02d41c843e8366c] [3a02178a101a5048bc1323e71bd8ba47][57f99aaad472583db190cb69d3964632]
Author	M. Nitsche	[ba72d98048315edeaff09c9b621c053f][90bc3834d7ce52fdbf062a89fb21ba41] [5805eb59c08b50d4abffd8ee83e92860][ca66fcea3ec056f9b0a6f32bead8cc04]
Author	S. Cortese	[2ca98f525b3f5acb8cad48dc0c951e78][6c0c08d138da51669640bc6c9f6d3bfa] [3f613aad4a4a58e2883b4f48f1014bde][0f581ace5b1d508fa65b9adae6e57e44]
Journal	*Journal of Psychiatry & Neuroscience*	[1afbb290b3445f228f78d607c27b4c71][029811a5e5985ccd928708c2d4fb1ca1] [87c357401b4f5b89a23f3a078420f77e]
Journal	*Neuroscience and Biobehavioral Reviews*	[96a2963096f1584fa8d5444f4ee31f67][44631d879b9c558da02d41c843e8366c] [7f3e5dbccc1f5b328a64aa7a073c7822]
Journal	*Frontiers in Psychiatry*	[3f7945b2ff2a58929732e94dbb2c5ef0][2d798015117d58c3bc842229c3bc481e]

FIGURE 6 Authors and journals appearing most in corpus

4. Discussion

The best-supported part of the claim is that ADHD often involves altered arousal and altered sensory processing, and that these differences relate to executive functioning. That is backed by a systematic review of autonomic studies, a meta-analysis of sensory-processing studies, and multiple cross-sectional studies linking sensory measures to inhibition, working memory, and behavior (Bellato et al., 2019; Jurek et al., 2025; Li et al., 2022; Owen et al., 2024). The literature also consistently shows that executive deficits in ADHD are real but heterogeneous, which makes any single mechanism incomplete (Onandia-Hinchado et al., 2021; Salehinejad et al., 2019).

The weaker part is the stronger wording of "rely on concurrent external sensory stimulation." Some experiments show acute benefits from white noise, visual stimulation, or neuromodulation on attention, inhibition, or working memory (Baijot et al., 2016; Chen et al., 2022; Nejati et al., 2024). But the intervention literature is inconsistent across raters and outcomes, and larger syntheses conclude that non-pharmacological neurostimulation effects are limited, partial, or uncertain for clinical use (Ostinelli et al., 2025; Westwood et al., 2020; Salehinejad et al., 2020; Zhang et al., 2025). The most direct caution comes from the 2026 phase 2b eTNS trial, which found no significant benefit on pediatric ADHD symptoms despite good tolerability (Conti et al., 2026).

The mechanistic story is also contested. White-noise benefits are often interpreted through hypo-arousal, optimal-stimulation, or moderate-brain-arousal models (Baijot et al., 2016; Richter et al., 2023). Yet a 2024 experimental paper found that both pink noise and a pure tone improved ADHD-related performance traits, challenging the specific stochastic-resonance account of the MBA model (Rijmen & Wiersema, 2024). Sensory input can help when it raises alertness or signal salience, but sensory hypersensitivity and poor gating can also worsen distraction and impair complex multisensory integration (Micoulaud-Franchi et al., 2019; Schulze et al., 2021).

The practical implication is cautious: external stimulation appears to function as a compensatory aid for some ADHD phenotypes rather than as a defining requirement of ADHD. Personal treatment decisions should be discussed with a licensed clinician, because this literature does not support a universal sensory-based prescription and many findings remain subgroup-specific.

Claim	Evidence Strength	Reasoning	Papers
ADHD is associated with atypical sensory processing across multiple domains.	Strong	Meta-analysis across 30 studies shows broad sensory atypicalities, though heterogeneity is high.	(Jurek et al., 2025)
ADHD often involves altered arousal regulation, commonly toward hypo-arousal.	Moderate	Systematic review supports this trend, but almost half of findings were null.	(Bellato et al., 2019)
External sensory stimulation can improve attention or inhibition in some ADHD samples.	Moderate	Multiple experiments show benefit, but effects depend on stimulus, subgroup, and task.	(Baijot et al., 2016; Lin, 2022; Chen et al., 2022)
Sensory-processing differences are linked to executive dysfunction in ADHD.	Moderate	Several observational studies show mediation or correlation with inhibition and working memory.	(Li et al., 2022; Owen et al., 2024; Micoulaud-Franchi et al., 2019)
People with ADHD generally require concurrent external	Weak	The literature supports subgroup-specific benefit, not a universal	(Ostinelli et al., 2025; Conti et al., 2026;

Claim	Evidence Strength	Reasoning	Papers
stimulation to function optimally.		dependence, and some large trials are negative.	Rijmen & Wiersema, 2024)

FIGURE 7 Key claims and evidence across included studies

5. Conclusion

Current evidence suggests that individuals with ADHD do not uniformly rely on concurrent external sensory stimulation, but a meaningful subset appears to benefit from it for arousal regulation and selected executive functions. The strongest evidence supports atypical sensory processing and altered arousal in ADHD, while the evidence for stimulation as a general compensatory requirement remains moderate to weak and highly heterogeneous (Jurek et al., 2025; Bellato et al., 2019; Ostinelli et al., 2025).

Research Gaps

The main gaps are not whether sensory stimulation ever helps, but who benefits, under which sensory conditions, and whether acute laboratory gains translate into durable real-world executive improvement.

Topic/Outcome	RCTs	Mechanism	Long-term Outcomes	Real-world Generalization
White noise for attention/inhibition	3	4	1	2
Sensory seeking and EF links	1	5	1	2
Peripheral visual stimulation	1	1	1	1
tDCS/tRNS and EF	10	7	3	3
eTNS and arousal regulation	2	3	2	2

Open Research Questions

The next studies need to move from broad trait-level claims to phenotype-specific, mechanism-linked tests.

Question	Why
Which ADHD sensory profiles predict benefit from white noise or other concurrent stimulation during executive tasks?	Current evidence shows subgroup variability, but predictors of benefit remain unclear across age, task, and sensory phenotype.
Do acute gains from sensory stimulation translate into durable improvements in daily executive functioning?	Many studies measure short-term laboratory performance, while long-term clinical and ecological outcomes remain sparse or inconsistent.

Question	Why
Are stimulation benefits driven by arousal normalization, salience enhancement, or reduced mind-wandering?	Competing mechanisms remain unresolved, and recent experiments challenge specific moderate-brain-arousal accounts.

In answer to the question asked: ADHD is associated with altered arousal and sensory processing, and concurrent external stimulation can support executive functioning in some individuals, but the evidence does not support a universal reliance.

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