***Æon Knowledge Project — WHITE PAPER***

***The Adversity Catalyst Theory (ACT)***

***Socio‑Economic Pressure as a Driver of Rapid Cognitive Development, with ADHD as a Potential Amplifier — Including the Interest‑Based Nervous System (IBNS) Dynamic***

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***Disclaimer:*** *This white paper synthesizes current research and proposes testable hypotheses. It is not medical advice and does not substitute for clinical diagnosis or treatment. ADHD constructs discussed herein (e.g., IBNS) include clinical/practice frameworks; see Limitations for scope.*

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***Table of Contents***

1. *Abstract …………………………………………………………………………………*
2. *Executive Summary …………………………………………………………………*
3. *Background & Motivation …………………………………………………………*
4. *Core Constructs & Definitions ……………………………………………………*
5. *Mechanisms of Action ………………………………………………………………*
6. *Evidence Snapshot ……………………………………………………………………*
7. *Case Profiles (Ethics‑compliant) …………………………………………………*
8. *Empirical Program (Cross‑Sectional, Longitudinal, Simulation) …………*
9. *Policy & Practice Implications ……………………………………………………*
10. *Limits, Caveats & Falsifiability …………………………………………………*
11. *Ethics & Guardrails …………………………………………………………………*
12. *Implementation Roadmap …………………………………………………………  
    References ……………………………………………………………………………………  
    Appendix A — Replacement Wording for Sensitive Claims  
    Appendix B — IMI Task Templates / Prereg Checklist  
    Appendix C — Cross‑Sectional Methods (Pre‑Reg Ready)  
    Appendix D — RL Environment Spec & Prereg Scaffold*

***Abstract***

*The Adversity Catalyst Theory (ACT) proposes that under sustained socio‑economic constraint, individuals who adopt a self‑mandated growth rule can achieve selective, high‑level performance—especially when motivation is interest‑gated (IBNS). ADHD may moderate this pathway via hyperfocus and divergent search under interest. We specify falsifiable predictions, validated instruments for hyperfocus, and a preregistered empirical program across behavioral, neuroimaging, and simulation layers. We caution against romanticizing adversity: benefits are expected primarily under moderate, scaffolded conditions; chronic, unbuffered stress harms cognition and health.*

***Executive Summary***

*This edition tightens definitions and aligns claims with current evidence. ACT frames certain forms of adversity as catalytic rather than purely detrimental: under sustained socio‑economic pressure, some individuals develop a strong internal mandate to excel, accelerating growth in selected cognitive domains. We integrate ADHD as a possible moderator via the Interest‑Based Nervous System (IBNS) concept: when intrinsically engaged, many ADHD individuals demonstrate hyperfocus and divergent problem‑solving; when disengaged, performance drops. IBNS is a clinical framework popularized by William Dodson, with growing—but still limited—peer‑reviewed operationalization. Hyperfocus has emerging measurement support (e.g., AHQ‑D, 2024), while evidence is mixed on whether hyperfocus is specific to ADHD.*

*What changed in 2.3  
• Removed or corrected claims that were overstated or weakly sourced (e.g., effects of stress on “enhancing PFC function,” “85%+ literature alignment,” and mobility claims).  
• Clarified ADHD prevalence (children ~5–8%; adults ~2.5–3.1% persistent) and added primary sources.  
• Rewrote the stress mechanism to reflect inverted‑U catecholamine effects and potential stress inoculation (“steeling”) in moderation; high chronic stress impairs prefrontal functions.  
• Replaced/qualified sources on IBNS and hyperfocus; added mixed‑evidence caveat.  
• Corrected socio‑economic mobility/inventor claims (exposure and parental income are strong predictors of innovation; substantial “lost Einsteins”).  
• Marked historical ADHD attributions as speculative; retained documented cases (e.g., Branson, Biles) and reframed others to focus on adversity, not diagnosis.  
• Converted the AI simulation “results” into a preregistered proposal (no fabricated numbers).*

1. *Introduction  
   Intelligence research often contrasts genetic endowment with enrichment. ACT proposes a third pathway: under chronic constraint, individuals who adopt a self‑imposed standard of transcendence may develop exceptional competencies—especially in tasks aligned with intrinsic motivation and survival‑relevant rewards. ADHD may sometimes amplify this via IBNS: interest, novelty, challenge, and urgency can spike engagement (hyperfocus) on self‑mandated goals. IBNS remains a clinical framing; peer‑reviewed constructs (e.g., hyperfocus) are now quantifiable, and evidence suggests hyperfocus occurs across populations with higher rates in ADHD, but not exclusively so.*
2. *Theoretical Foundations  
   2.1 Adversity Catalyst — refined  
   A catalytic configuration comprising:  
   • Chronic Constraint: ongoing poverty, instability, stigma, or institutional neglect.  
   • Cognitive Dissonance: awareness that “ability ⇒ mobility” is promised socially, yet blocked structurally.  
   • Self‑Mandated Growth: an internal rule (e.g., “I will think my way out”), transmuting constraint into sustained effort.  
   • ADHD/IBNS as Moderator (qualified): neurodivergent traits (novelty‑seeking, rapid switching, intensity under interest) may channel effort into high‑leverage domains. Hyperfocus can produce deep, time‑insensitive work when the task is compelling; conversely, disengagement from low‑interest tasks conserves energy. Evidence supports hyperfocus as measurable; specificity to ADHD is debated.*

*2.2 Mechanism of Action — corrected and evidence‑aligned  
• Neurobiological Stress Response (inverted‑U): Acute/moderate challenges can transiently enhance focus; excessive or chronic stress elevates catecholamines/glucocorticoids and impairs prefrontal cortex (PFC) functions (working memory, cognitive control). Chronic stress leads to reversible PFC changes; relief/mentoring can restore function. Thus, ACT predicts catalytic effects primarily at moderate, scaffolded adversity levels.  
• Motivational Loop: In under‑resourced contexts, extrinsic supports are sparse; intrinsic motivation and mastery goals (self‑determination) become key. With ADHD/IBNS, interest‑aligned domains receive disproportionate effort (hyperfocus) and exploration; misalignment yields withdrawal—often misread as “inconsistency.”  
• Symbolic Compression & Heuristics: Scarcity narrows bandwidth (tunneling) yet can sharpen immediate focus. Over time, some learners develop compact, analogy‑rich mental models to economize cognition—useful under constraint but vulnerable to myopia without corrective feedback.*

1. *Literature Snapshot (curated & corrected)  
   Post‑Traumatic Growth: Exposure to adversity can catalyze positive shifts in priorities and perspective for a subset of people (Tedeschi & Calhoun, 2004).  
   Stress & the PFC: Chronic stress impairs PFC‑dependent control/attention; effects can be reversible with recovery (Liston et al., 2009; Lupien et al., 2009; McEwen, 2017). The catecholamine–performance relation follows an inverted‑U; “more stress” ≠ “more control.”  
   Scarcity & Bandwidth: Scarcity reallocates attention (focus dividend) but taxes bandwidth (“tunneling,” “bandwidth tax”), reducing fluid intelligence/executive control in the moment (Shah, Mullainathan, & Shafir, 2012; Mani et al., 2013; Mullainathan & Shafir, 2013).  
   Resilience/Steeling: Moderate, not extreme, cumulative adversity associates with better long‑term outcomes vs. zero or high adversity (U‑shape) (Seery, Holman, & Silver, 2010); resilience is dynamic and learnable (Rutter, 2012).  
   ADHD Prevalence: Children/adolescents ~5–8% (varies by method); persistent adult ADHD ~2.5–3.1% globally; symptomatic adult ADHD higher (Song et al., 2021; Polanczyk et al., 2014; Ayano et al., 2023).  
   ADHD & Creativity/Hyperfocus: Adults with ADHD often show higher divergent thinking/creative achievement under certain conditions; hyperfocus is reported and now quantified (White & Shah, 2006, 2011; Boot et al., 2017 review; Hupfeld et al., 2018, 2024). Evidence is mixed on specificity (Groen et al., 2020).  
   IBNS: A clinician‑proposed framework (Dodson) for ADHD motivation; widely discussed in clinical/psychoeducational venues; rigorous experimental validation is emergent. Use with caveats.  
   Mobility & Innovation: High‑ability children from low‑income families innovate at much lower rates than similar‑ability high‑income peers; exposure to inventors in childhood predicts later invention (“lost Einsteins”) (Chetty et al., 2018). This contradicts any claim that high achievers disproportionately arise from lower quartiles; structural barriers suppress visible output.*
2. *Case Evidence (emphasis on adversity; diagnoses avoided unless documented)  
   Illustrative (non‑exhaustive) figures whose work emerged from pronounced adversity:  
   • Srinivasa Ramanujan — severe poverty; largely self‑taught; letters to Hardy from a clerical post; foundational contributions to number theory.  
   • Marie Skłodowska Curie — higher education barred for women under Russian rule; attended clandestine “Flying University”; pioneered radioactivity; two Nobel Prizes.  
   • Frederick Douglass — enslaved; self‑taught literacy; global abolitionist voice reshaping civil rights discourse.  
   • Simone Biles — early instability; ADHD documented; elite performance and advocacy for athlete mental health.  
   • Richard Branson — dyslexia; self‑reported ADHD; built Virgin Group across multiple industries.*
3. *Empirical Validation Framework (updated)  
   5.1 Cross‑Sectional Study  
   Sample: n=~300 (18–30) across SES strata; ADHD subgroup n≈100.  
   Measures: Hardship Index (lifetime adversity), Self‑Standard Scale, advanced cognitive battery (fluid reasoning, working memory, creative/divergent tasks), ASRS‑v1.1, validated hyperfocus scale (AHQ‑D), interest engagement tasks (choice & persistence under interest vs. importance).  
   Hypotheses: (H1) High hardship × high self‑standard predicts superior performance on novelty/abstraction tasks; (H2) ADHD traits and hyperfocus (AHQ‑D) moderate H1 via interest alignment.*

*5.2 Longitudinal Neuroimaging Cohort  
Design: 5‑year fMRI/DTI of adolescents under adversity (mentored vs. unmentored), stratified by ADHD/hyperfocus; tasks manipulate interest vs. importance/urgency.  
Endpoints: Trajectories in PFC/frontoparietal connectivity; changes in creative/novelty performance under interest; stress biomarkers; moderation by mentorship (buffering chronic stress).*

*5.3 AI‑Based Simulation (clarified — proposal, no results claimed)  
We propose two RL agents with identical architectures. Agent A (stable rewards) vs. Agent B (volatile rewards + random shocks mirroring life events). ADHD/IBNS proxy: inject action noise (inattention) and “interest boosts” (state‑dependent reward multipliers) to simulate hyperfocus; devalue low‑interest states to model disengagement.  
Planned Metrics: action entropy (exploration), abstraction depth (feature compression), and planning horizon. Note: Prior edition’s numeric “results” were illustrative; they are removed pending preregistered experiments and public code/data release.*

1. *Policy & Practice Implications (concise)  
   • Talent Discovery: Screen for self‑mandated growth + interest‑aligned hyperfocus in under‑resourced learners; avoid over‑reliance on compliance‑based metrics that miss IBNS profiles.  
   • Educational Design: Offer interest‑driven, challenge‑calibrated curricula; provide mentorship to shift chronic stress toward scaffolded challenge.  
   • Innovation Equity: Increase exposure to role models and hands‑on invention programs in low‑income communities to address the “lost Einsteins” gap.  
   • Clinical/Ethical Note: Do not romanticize adversity. Chronic, unbuffered stress harms cognition/health. The goal is protective scaffolding, not hardship.*
2. *Limits & Falsifiability  
   • Boundary Conditions: ACT predicts benefits primarily under moderate, supported adversity with strong self‑mandate; severe unbuffered adversity should not yield gains and may produce lasting harms.  
   • ADHD/IBNS Caveat: IBNS is a clinician’s framework; hyperfocus has empirical tools but is not ADHD‑specific. Strong claims require preregistered tests.  
   • Competing Explanations: Effects may reflect selection (survivor bias), resource substitution, or opportunity exposure rather than adversity per se.  
   • Disconfirmations: Null or negative moderation by ADHD/hyperfocus on interest‑aligned tasks; failure of mentorship to buffer stress effects; no U‑shaped adversity–outcome relation in large samples.*

*References (curated)  
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Biographical/Context: Ramanujan—primary letters/biographies; Curie—on Flying University; Biles—public confirmation of ADHD/TUE; Branson—public interviews acknowledging ADHD/dyslexia.*

*Appendix A (optional instruments)  
• Self‑Standard Scale (prototype): items indexing internalized excellence mandates.  
• Interest Alignment Task Battery: forced‑choice + persistence under interest vs. importance.  
• AHQ‑D (licensing per authors) and ASRS‑v1.1 (WHO) for screening/traits.*

*Appendix B (preregistration checklist for the AI simulation)  
• Public repo + fixed seeds  
• Report ablations of “interest boost”/noise components  
• Report full learning curves and confidence intervals  
• No headline claims without convergence diagnostics*

***Appendix C — Cross‑Sectional Study: Methods (Pre‑Registration Ready)***

***C1. Overview & Confirmatory Hypotheses***

***Goal.*** *Test whether adversity (Hardship Index) and* ***Self‑Mandated Growth (SMG)*** *predict superior performance on novelty/abstraction tasks, and whether* ***ADHD traits/hyperfocus*** *moderate this via* ***interest alignment (IMI)****.*

***H1 (Main):*** *Hardship × SMG → higher novelty/abstraction composite (controlling g, education, sleep, meds, comorbidity).****H2 (Moderation):*** *(Hardship × SMG) effect is amplified by ADHD trait level and by* ***IMI*** *(interest‑driven performance delta).****H3 (Buffering):*** *Mentorship/exposure variables attenuate the negative effects of chronic stress on sustained attention but preserve interest‑aligned advantages.*

***C2. Participants & Power***

* ***N ≈ 300****, ages 18–30, stratified by SES (parental income/education, neighborhood indicators). Oversample ADHD to* ***n ≈ 100*** *(confirmed by ASRS‑v1.1 + clinician interview subset).*
* ***Inclusion:*** *fluent in study language; normal/corrected vision; consent; optional stimulant users recorded (state at test logged).*
* ***Exclusion:*** *psychosis, uncontrolled seizures, acute major depression episode (safety), active substance dependence; data quality flags (see C8).*
* ***Power:*** *Target small interaction (Hardship × SMG × ADHD × IMI). Preliminary target based on small‑effect simulations; final numbers preregistered with code.*

***C3. Measures***

***C3.1 Hardship Index (composite):***

* ***Economic Instability:*** *income volatility, food/housing insecurity (12‑mo + lifetime); employment volatility.*
* ***Adverse Experiences:*** *ACEs (non‑identifying summary), neighborhood risk, discrimination index.*
* ***Protective Factors:*** *mentorship access, safe space availability, autonomy at school/work.*

***C3.2 Self‑Mandated Growth (SMG) — Item Pool (prototype, 14 items):*** *7‑point Likert (1=Strongly disagree … 7=Strongly agree); reverse‑score where indicated.  
Sample items:*

1. *I hold myself to a standard of excellence that does not depend on others’ approval.*
2. *When resources are scarce, I double down on learning/creating what matters to me most.*
3. *I believe I can change my conditions through mastery of a domain.*
4. *Setbacks increase my determination to improve my skills.*
5. *I feel a personal duty to turn adversity into an advantage.*
6. *I organize my life around a long‑term project I chose for myself.*
7. *If a task doesn’t advance my chosen mission, I minimize time on it.*
8. *(R) I only work hard when someone is watching or grading me.*
9. *I plan deep work sessions to make measurable progress on my goals.*
10. *I track my growth with self‑defined benchmarks.*
11. *When I fall short, I redesign my system rather than blame the situation.*
12. *I prefer autonomy over external supervision when I work.*
13. *I can explain exactly why my current project matters to my future.*
14. *I would keep learning my domain even without credentials or pay.****Scoring:*** *Mean of all items (after reverse‑scoring).* ***Structure:*** *Hypothesize 2 factors (Autonomous Mandate; Mission‑Aligned Focus); test via EFA→CFA; retain short form (8 items) if α≥.80 and ω≥.80.*

***C3.3 ADHD/Hyperfocus:***

* ***ASRS‑v1.1*** *(symptom screener).*
* ***AHQ‑D (12‑item)*** *dispositional hyperfocus; plus single‑session* ***HF episode log*** *(see C5).*
* ***Clinician interview*** *subset (MINI‑style ADHD module) for diagnostic confirmation (~30%).*

***C3.4 Interest Alignment Task Battery (IATB) & IMI:***

* ***Interest Identification:*** *Pre‑session inventory across domains (STEM topics, music, art, entrepreneurship, social justice, etc.). Identify* ***Top‑2 High‑Interest (HI)*** *domains and* ***Low‑Interest (LI)*** *counter‑domains.*
* ***Tasks (matched difficulty, counterbalanced):***
  + ***Concept Mapping*** *(build structured map for HI vs. LI topic prompts).*
  + ***Constrained Problem Solving*** *(e.g., logic puzzles; math/CS snippets themed HI vs. LI but equated in structure).*
  + ***Analogical Reasoning*** *(map A→B→C analogies under HI/LI contexts).*
  + ***Short Essay/Code Sketch*** *(HI vs. LI prompt with length/time control).*
* ***Primary IMI metric:*** *z‑(Accuracy/Depth/Quality)\_HI − z‑(Accuracy/Depth/Quality)\_LI. Secondary: RT costs, micro‑break frequency, task‑switch latency, time‑on‑task. Optional: pupil dilation/eye‑tracking if available.*
* ***Composite Outcomes:******Novelty/Abstraction Index*** *(expert‑rated + rubric),* ***Deep Work Persistence*** *(uninterrupted minutes),* ***Strategic Compression*** *(concept density/unique analogies).*

***C3.5 Covariates/Controls:*** *g (ICAR‑16 or Raven), working memory (digit span or n‑back), sleep (past 24h), caffeine meds, mood (PANAS), screen time, typing speed baseline.*

***C4. Procedure***

1. *Consent → demographic/SES → Hardship/Protective → ASRS, AHQ‑D → interest inventory.*
2. *Baseline cognitive tests.*
3. *IATB (HI/LI blocks; order counterbalanced).*
4. *10‑minute recovery; HF episode debrief (if any).*
5. *Clinician interview subset (scheduled).*

***C5. Hyperfocus Episode Capture (Lab + EMA)***

* ***Lab:*** *Participants can press a “zone” key to mark onset/offset; collect uninterrupted duration, subjective absorption (0–100), time distortion, restart cost after interruption.*
* ***EMA (optional 7‑day):*** *6 prompts/day; if HF occurred, log domain, trigger (interest/novelty/urgency), duration, costs/benefits.*

***C6. Outcomes & Analysis***

* ***Confirmatory DVs:*** *Novelty/Abstraction Index; IMI; Deep Work Persistence.*
* ***Model:*** *Linear mixed‑effects with random intercepts (participant) and fixed effects for Hardship, SMG, ADHD (trait or dx), IMI, and all interactions; covariates entered hierarchically. Robust SEs; BH‑FDR for multiple tests.*
* ***Sensitivity:*** *Equivalence tests for nulls; robustness to covariate sets; leave‑one‑task‑out.*

***C7. Missing Data & Exclusions***

* ***Pre‑reg thresholds:*** *<60% task completion; RT <250ms on >10% trials; identical responses on >80% of items; failed attention checks → exclude.*
* ***Imputation:*** *MICE for item‑level missing if <10%; otherwise listwise for that endpoint.*

***C8. Transparency***

* *Materials, code, and de‑identified data on OSF upon acceptance; timing preregistered; any deviations documented.*

***Appendix D — RL Environment Spec & Preregistration Scaffold***

***D1. Formalization (MDP)***

* ***States S:*** *Gridworld with feature vector φ(s): (x,y), resource tokens, hazards, visibility radius, time‑step, event context (recent shocks), and a* ***topic tag*** *∈ {t₁…t\_k} representing* ***interest domains****.*
* ***Actions A:*** *{move N/E/S/W, wait, harvest, craft, communicate (stub)}.*
* ***Transition T:*** *p(s′|s,a) with* ***non‑stationary drift*** *(reward locations can move; hazards spawn/decay stochastically).*
* ***Rewards R:*** *Base rewards for goal completion; penalties for hazards/scarcity;* ***interest boost*** *multiplier m>1 when topic tag matches agent’s intrinsic vector* ***ι****;* ***urgency windows*** *temporarily scale rewards/penalties.*
* ***Discount γ:*** *0.95 default; ablation at {0.90, 0.99}.*

***D2. Conditions***

* ***Comfort:*** *Stationary rewards; low hazard rate; no shocks; no interest multipliers.*
* ***Adversity:*** *Non‑stationary rewards; stochastic penalties;* ***shock process*** *(Poisson with typed events: loss, rejection, embarrassment, rare kindness). Shocks alter reward scales, visibility, and memory decay for K steps.*

***D3. ADHD/IBNS Proxies***

* ***Noisy Attention:*** *With prob ε\_t, action is overridden with random or habitual action; ε\_t schedule (higher early, decays or spikes after shock).*
* ***Interest Boost:*** *For states with tag ∈ Top‑M topics, reward × m (e.g., 1.5–2.0);* ***disengagement cost*** *increases switch costs for off‑interest states.*
* ***Urgency Gate:*** *When deadline flag=1, interest and control transiently increase (reduced ε\_t, boosted planning depth).*

***D4. Agents & Learning***

* ***Policy:*** *DQN (baseline) plus model‑based agent (tree search / successor representation) for planning‑horizon estimation.*
* ***Training:*** *10⁴–10⁵ episodes per seed;* ***seeds ≥ 20****. Replay buffer; target network updates; epsilon‑greedy exploration.*

***D5. Metrics***

* ***Action Entropy*** *at matched states.*
* ***Representation Compression:*** *MI between latent layer z and ground‑truth features; MDL‑style description length.*
* ***Planning Horizon:*** *Look‑ahead depth (model‑based) or SR span (model‑free proxy).*
* ***Sample Efficiency:*** *AUC of reward curve over episodes 1…N.*
* ***Stability/Resilience:*** *Performance drop and recovery time after shocks.*

***D6. Ablations***

* *Remove interest boost; remove shocks; fix rewards stationary; set ε\_t=0; remove urgency gate; randomize topic tags.*

***D7. Preregistration Fields***

* ***Hypotheses:*** *Adversity×(Interest boost + urgency) yields higher planning horizon and resilience; ADHD‑proxy noise helps exploration only with interest boost present.*
* ***IVs/Moderators:*** *Condition, interest multiplier, ε schedule, shock rate, urgency windows.*
* ***DVs:*** *Entropy, compression, planning horizon, sample efficiency, stability.*
* ***Stopping:*** *Fixed episodes; no early stopping aside from catastrophic divergence rules.*
* ***Reporting:*** *Mean±CI across seeds; full learning curves; code release; config files; compute budget and hardware.*

***D8. Ethics & Scope***

* *Simulation is* ***not*** *evidence of human benefit; it tests mechanistic plausibility. Do not generalize beyond the specified mappings; treat as generating hypotheses for human studies.*