ADVERSITY AND RELATIVE PERFORMANCE

**Within-person cognitive performance across abilities among adversity-exposed people in the SECCYD**

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**Abstract**

The idea that some skills might be enhanced by adversity is gaining traction. For example, research leveraging the hidden talents approach has uncovered a few narrow, context-dependent skills enhanced by adversity. Yet, for a field to grow, we must not dig too deep, too fast. In this paper, we zoom out and evaluate two basic features of the hidden talents approach. First, adversity simultaneously decreases and increases test performance, depending on the skill. Although commonly assumed, this assertion is rarely tested. Second, empirical work suggests enhanced skills manifest within- not between- individuals. Although studies have compared the same skill in different testing contexts, research comparing different skills have tested, at most, two or three skills. One reason is that the hidden talents approach uses a functional-link approach to understanding which skills fit the challenges of adverse environments. We expand on this finding, by analyzing ten skills in the Woodcock Johnson Cognitive and Achievement test battery in a large, prospective longitudinal dataset. We use a within-person modeling strategy to examine how exposure to harshness and unpredictability relate to *relative* decreases and increases in subtest performance compared to a person’s overall performance. Our goal is to sketch adversity-shaped cognitive profiles, identify possible drivers of lowered overall performance, and map out sets of ‘intact’ skills.

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Developmental science commonly asserts that adversity-exposure in development lowers cognitive performance, an assumption built on decades of research (Duncan et al., 2017; Farah et al., 2006; Hackman et al., 2010, 2014; McLaughlin et al., 2019). In recent years, adaptation-based frameworks, rooted in the idea that adversity might enhance certain skills, has challenged this notion—and it is gaining traction (Ellis et al., 2020; Frankenhuis, Young, et al., 2020; Frankenhuis & de Weerth, 2013; Frankenhuis & Nettle, 2020). At its inception, the goal of this framework was to inspire a more well-rounded view of stress, adversity, and skill development—one that incorporated the strengths of people from disadvantaged backgrounds (Frankenhuis & de Weerth, 2013). As it develops, the core task of adaptation-based research is to “uncover a high-resolution map of specific cognitive abilities that are enhanced as a result of growing up under high-adversity conditions” (Ellis et al., 2017, p. 562).

To draw this map, adaptation-based research has used confirmatory research designs constructed with adaptive logic. The idea behind an adaptive confirmatory approach is that adversity should shape skills that help people solve fitness-related challenges. This prompts researchers to think about the specific challenges adversity might pose and the abilities people need to meet them. The researcher uses this logic to build an intuitive bridge between a skill and an environment and a confirmatory research study idea is born. They then set out to measure an exposure to adversity, performance on a skill, and look for enhanced performance. This approach has many appealing features, but it comes with pitfalls. If employed too often—without complimentary approaches— emerging research programs can miss new insights and progress might stagnate. In the worst case, exclusive focus on confirming adaptive hypotheses can promote strategic ambiguity.

Our aim is to compliment adaptation-based, confirmatory research with principled exploration (Flournoy et al., 2020; Rozin, 2001). We return to our map of cognitive skills shaped by adversity. We zoom out, take stock, and survey the landscape. What territory needs exploration and which areas need re-mapping? Rather than leaning on adaptive logic to guide our design, we step back and examine the essential features of an adaptation-based framework. First, a skill might be enhanced when it helps meet environmental challenge but lowered when it does not. Therefore, adaptative developmental processes can simultaneously decrease and increase test performance, depending on the skill. Although commonly assumed, this assertion is rarely tested. Relatedly, empirical work suggests enhanced skills manifest within- not between- individuals. Although studies have compared the same skill in different testing contexts, research comparing different skills have tested, at most, two or three skills. We need within-person designs examining performance across many more skills. Finally, research often focuses on comparing lowered and enhanced test performance, but some skills might remain ‘intact’, or unaffected by adversity exposure (Frankenhuis, Young, et al., 2020). We know little about the intact skills of people exposed to adversity. We also know little about the drivers of lowered performance. Traditional approaches collapse many abilities into composites and find adversity lowers performance. But a smaller set of skills could drive this effect. Both intact skills and drivers of lowered performance add much-needed nuance to our map.

We argue that adaptation-based frameworks provide useful guideposts, but we should use shovels, not scalpels to break new ground. In this paper, we focus on developing basic criteria for identifying enhanced, intact, and (lowered or enhanced) performance drivers. We apply these criteria to examine how exposure to harshness and unpredictability shape cognitive profiles across ten skills assessed in the Woodcock Johnson Cognitive and Achievement test battery (Woodcock, 1990; Woodcock et al., 1990). We use a within-person modeling strategy to examine *relative* decreases and increases in subtest performance compared to a person’s overall performance. Our goal is to excavate new ground and re-map old territory to feed theory development. In doing so, we position ourselves to identify possible drivers of lowered overall performance, map out sets of ‘intact’ skills, and discover relative enhancements. We also hope to encourage adaptation-based research to conduct more principled exploration to more systematically draw our map of cognitive skills of people exposed to adversity.

**Adaptation-based Frameworks: Essential Features and Basic Insights**

Over the past decade, empirical work has uncovered a handful adversity-enhanced skills, including attention-shifting (Fields et al., 2021; Mittal et al., 2015), working memory updating (Nweze et al., 2021; Young et al., 2018, 2022), social dominance reasoning (Frankenhuis, de Vries, et al., 2020), and emotion recognition (Brener et al., in press). These findings are new and exciting, but they come with caveats. For example, across studies, findings are difficult to compare. Studies use different measures of adversity e.g., self-reported unpredictability (Mittal et al., 2015; Young et al., 2018), caregiver instability (Fields et al., 2021), violence exposure (Frankenhuis, de Vries, et al., 2020; Young et al., 2022), and parental neglect (Nweze et al., 2021). They measure performance with different cognitive tasks, for example working memory updating (Young et al., 2018, 2022) versus working memory capacity (Nweze et al., 2021), and experimental designs such as manipulations of setting (Young et al., 2018, 2018), task content (Frankenhuis, de Vries, et al., 2020; Young et al., 2022), or no manipulations (Fields et al., 2021; Nweze et al., 2021). Setting aside measurement and design differences, some adaptation-based studies even find that conditions thought to raise performance actually lower it. For example, youth from poverty tended to score lower on math items about social relations, money, and food—items thought to be particularly relevant to adversity-exposed youth—compared to other math items (Duquennois, 2022; Muskens, 2019).

* Basic assumptions
  + Development shapes skills
  + People should develop skills are those abilities that meet challenges
  + Because the fit between a skills and particular challenges varies, people should have strengths and weakness
* Basic Insights
  + Enhanced skills are highly context dependent
    - Test setting, context
    - Dimension of adversity
  + Enhanced skills tend to manifest within-person
    - Relative increases in performance compared to oneself
    - Very little evidence performance increases compared to others

Functional logic is intuitive, useful guide to generate hypotheses

Miss things that are adaptive, outside our radar, and patterns that turn out counterintuitive

Prototype plots

**Statistical Criteria for Principled Exploration**

**The Current Study**

**Method**

**Participants**

Families were initially recruited for the NICHD SECCYD in 1991. A total of 1364 families met all the prescreening criteria, namely that mothers: (a) were age 18 or older, (b) did not plan to move, (c) had a newborn without any known disabilities (and could leave the hospital within one week), (d) had no history of substance abuse, (e) could speak English, and (f) lived within 1 hour driving distance from the research lab and were in a relatively safe neighborhood. More information about recruitment and selection procedures is available from the study (NICHD Early Child Care Research Network, 2005; see https://www.icpsr.umich.edu/web/ICPSR/series/00233). The current analyses included participants with non-missing data on most predictors and outcome variables through age 15 (N = 1156).

**Measures**

***Predictors***

**Unpredictability.**

**Harshness.**

***Outcomes***

**Picture vocabulary.**

* verbal comprehension/crystallized knowledge
* 5 assessments, 54 months, grades 1, 3, 5, and at 15 years

**Verbal analogies.**

* verbal fluid reasoning and crystallized knowledge
* 2 assessments, grade 3 and at 15 years

**Passage comprehension.**

* vocab and comprehension skill
* 3 assessments, grades 3, 5, and at 15 years

**Applied problems.**

* practical math problem solving skill
* 5 assessments, 54 months, grades 1, 3, 5, and at 15 years

**Memory for Sentences.**

* short term retrieval
* 3 assessments, 54 months and grades 1 and 3

**Incomplete words.**

* auditory processing
* 2 assessments, 54 months and grade 1

**Memory for names.**

* long term retrieval
* 2 assessments, grades 1 and 3

**Letter-word identification.**

* verbal knowledge
* 4 assessments, 54 months, grades 1, 3, 5

**Word attack.**

* auditory processing
* 2 assessments, grades 1 and 3

**Calculations.**

* math calculations
* 2 assessments, grades 3 and 5

**Results**

**Data Analysis Strategy**

**Primary Analyses**

**Secondary Analyses**

**Discussion**

**References**

Duncan, G. J., Magnuson, K., & Votruba-Drzal, E. (2017). Moving Beyond Correlations in Assessing the Consequences of Poverty. In S. T. Fiske (Ed.), *Annual Review of Psychology, Vol 68* (Vol. 68, pp. 413–434). Annual Reviews. https://doi.org/10.1146/annurev-psych-010416-044224

Duquennois, C. (2022). Fictional Money, Real Costs: Impacts of Financial Salience on Disadvantaged Students. *American Economic Review*. https://doi.org/10.1257/aer.20201661

Ellis, B. J., Abrams, L. S., Masten, A. S., Sternberg, R. J., Tottenham, N., & Frankenhuis, W. E. (2020). Hidden talents in harsh environments. *Development and Psychopathology*, 1–19. https://doi.org/10/gjqwbs

Ellis, B. J., Bianchi, J., Griskevicius, V., & Frankenhuis, W. E. (2017). Beyond risk and protective factors: An adaptation-based approach to resilience. *Perspectives on Psychological Science*, *12*(4), 561–587. https://doi.org/10/gdtj9h

Farah, M. J., Shera, D. M., Savage, J. H., Betancourt, L., Giannetta, J. M., Brodsky, N. L., Malmud, E. K., & Hurt, H. (2006). Childhood poverty: Specific associations with neurocognitive development. *Brain Research*, *1110*(1), 166–174. https://doi.org/10/fv2dn8

Fields, A., Bloom, P. A., VanTieghem, M., Harmon, C., Choy, T., Camacho, N. L., Gibson, L., Umbach, R., Heleniak, C., & Tottenham, N. (2021). Adaptation in the face of adversity: Decrements and enhancements in children’s cognitive control behavior following early caregiving instability. *Developmental Science*, *24*(6), e13133. https://doi.org/10/gj7gh7

Flournoy, J. C., Vijayakumar, N., Cheng, T. W., Cosme, D., Flannery, J. E., & Pfeifer, J. H. (2020). Improving practices and inferences in developmental cognitive neuroscience. *Developmental Cognitive Neuroscience*, *45*, 100807. https://doi.org/10/gnbxdn

Frankenhuis, W. E., de Vries, S. A., Bianchi, J., & Ellis, B. J. (2020). Hidden talents in harsh conditions? A preregistered study of memory and reasoning about social dominance. *Developmental Science*, *23*(4), e12835. https://doi.org/10/ggb8qd

Frankenhuis, W. E., & de Weerth, C. (2013). Does Early-Life Exposure to Stress Shape or Impair Cognition? *Current Directions in Psychological Science*, *22*(5), 407–412. https://doi.org/10/f5cxhb

Frankenhuis, W. E., & Nettle, D. (2020). The Strengths of People in Poverty. *Current Directions in Psychological Science*, *29*(1), 16–21. https://doi.org/10/ggf5d6

Frankenhuis, W. E., Young, E. S., & Ellis, B. J. (2020). The hidden talents approach: Theoretical and methodological challenges. *Trends in Cognitive Sciences*, *24*(7), 569–581. https://doi.org/10.1016/j.tics.2020.03.007

Hackman, D. A., Betancourt, L. M., Gallop, R., Romer, D., Brodsky, N. L., Hurt, H., & Farah, M. J. (2014). Mapping the Trajectory of Socioeconomic Disparity in Working Memory: Parental and Neighborhood Factors. *Child Development*, *85*(4), 1433–1445. https://doi.org/10/f6fp5j

Hackman, D. A., Farah, M. J., & Meaney, M. J. (2010). Socioeconomic status and the brain: Mechanistic insights from human and animal research. *Nature Reviews Neuroscience*, *11*(9), 651–659. https://doi.org/10/b254c6

McLaughlin, K. A., Weissman, D., & Bitrán, D. (2019). Childhood adversity and neural development: A systematic review. *Annual Review of Developmental Psychology*, *1*(1), 277–312. https://doi.org/10/gj59n7

Mittal, C., Griskevicius, V., Simpson, J. A., Sung, S., & Young, E. S. (2015). Cognitive adaptations to stressful environments: When childhood adversity enhances adult executive function. *Journal of Personality and Social Psychology*, *109*(4), 604–621. https://doi.org/10.1037/pspi0000028

Muskens. (2019). *Hidden obstacles in education for students from low socioeconomic backgrounds:* [maastricht university]. https://doi.org/10.26481/dis.20191115mm

NICHD Early Child Care Research Network. (2005). *Child care and child development: Results from the NICHD study of early child care and youth development* (pp. xx, 474). The Guilford Press.

Nweze, T., Nwoke, M. B., Nwufo, J. I., Aniekwu, R. I., & Lange, F. (2021). Working for the future: Parentally deprived Nigerian children have enhanced working memory ability. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *62*(3), 280–288. https://doi.org/10/gphn59

Rozin, P. (2001). Social Psychology and Science: Some Lessons From Solomon Asch. *Personality and Social Psychology Review*, *5*(1), 2–14. https://doi.org/10/bhqn85

Woodcock, R. W. (1990). Theoretical Foundations of the Wj-R Measures of Cognitive Ability. *Journal of Psychoeducational Assessment*, *8*(3), 231–258. https://doi.org/10/ft7mjn

Woodcock, R. W., Johnson, M. B., & Mather, N. (1990). *Woodcock-Johnson psycho-educational battery—Revised*. DLM Teaching Resources.

Young, E. S., Frankenhuis, W. E., DelPriore, D. J., & Ellis, B. J. (2022). Hidden talents in context: Cognitive performance with abstract versus ecological stimuli among adversity-exposed youth. *Child Development*, *93*(5), 1493–1510. https://doi.org/10.1111/cdev.13766

Young, E. S., Griskevicius, V., Simpson, J. A., Waters, T. E. A., & Mittal, C. (2018). Can an unpredictable childhood environment enhance working memory? Testing the sensitized-specialization hypothesis. *Journal of Personality and Social Psychology*, *114*(6), 891–908. https://doi.org/10.1037/pspi0000124