Running head: OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

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A Cautionary Note

Word count: 2,419

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**Overstating the Role of Environmental Factors in Success:
A Cautionary Note**

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OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

Abstract

Several currently popular areas of research—brain training, mindset, grit, deliberate practice, and the bilingual advantage—are premised on the idea that environmental factors are the overwhelming determinants of success in real-world pursuits. Here, we describe the major claims from each of these areas of research, before discussing evidence for these claims, with a particular focus on meta-analyses. We then suggest that overemphasizing the malleability of abilities and other traits can have negative consequences for individuals, science, and society. We conclude with a call for balanced appraisals of the available evidence concerning this issue, to reflect current scientific discrepancies, and thereby enable informed individual decisions and collective policies.

Keywords: abilities, skills, interventions, environment, genetics.

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

Overstating the Role of Environmental Factors in Success:**A Cautionary Note**

I believe that if one always looked at the skies, one would end up with wings.

—Gustave Flaubert, *Pensées*, 1915.

The view that a person's environment plays a much greater role in determining success in the world than innate traits has long been a theme of psychological theorizing. Nearly a century ago, John Watson, the founder of behaviorism, articulated this view when he wrote, “[g]ive me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I’ll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents...” (Watson, 1930, p. 104). The appealing implication of this view is that anyone can become highly successful, whether it be in school, work, or a hobby.

While few, if any, contemporary scientists would endorse Watson's (1930) extreme view, the idea that individuals' capabilities are highly malleable, and thus that environmental factors are the overwhelming determinants of accomplishment in real-world pursuits, remains a powerful undercurrent in psychological research. Currently, this view is emphasized in five popular areas of research: *brain training*, *mindset*, *grit*, *deliberate practice*, and *the bilingual advantage*. Thousands of scientific articles have been published on these topics, which have also captured the popular imagination through books such as *Smarter: The new science of building brain power* (Hurley, 2014), *Mindset: The new psychology of success* (Dweck, 2006), *Grit: The power of passion and perseverance* (Duckworth, 2016), and *Peak: The new science of expertise*

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

(Ericsson & Pool, 2017). Some of these areas of research have also spawned lucrative commercial ventures. Brain training is a multibillion-dollar industry, and commercial mindset interventions are used in schools around the world.

Nevertheless, the central claims of each of these areas of research have been increasingly called into question in the scientific literature. Here, we briefly summarize evidence from each area of research, focusing on large-scale studies and meta-analyses. Our intent is not to criticize individual theorists—misleading statements can find their way to the media and popular beliefs *despite* caution expressed by the theorists (see, e.g., Duckworth, 2016). Rather, our goal is to present current evidence for the claims central to each area of research. We conclude that caution is warranted when considering both future research on these topics and translations of this research to real-world applications.

Brain Training

The premise of brain training is that the brain is “like a muscle,” in the sense that it can be strengthened through cognitive “exercise.” More specifically, the idea is that training in tasks that target core cognitive functions such as working memory, attention, and spatial ability generalizes to real-world situations that call on these functions. This claim of *far transfer* has been at least implicit in advertising claims by brain training companies (see Simons et al., 2016). Scientists have made similar claims, arguing that working memory training improves fluid intelligence (Jaeggi, Buschkuhl, Jonides, & Perrig, 2008) and that videogame playing enhances visuospatial abilities (Green & Bavelier, 2003).

Nevertheless, after more than a decade of intensive research on brain training, it is clear that far transfer is elusive. Several meta-analyses have demonstrated that the benefits of brain training are limited to the trained task, or to very similar tasks (*near transfer*). For example, a

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

meta-analysis by Melby-Lervåg and Hulme (2013), found “no convincing evidence of the generalization of working memory training to other skills” (p. 270). They also noted that working memory training studies are often plagued by major methodological problems, including use of research designs without appropriate control groups. More recently, Simons and colleagues conducted an exhaustive review of the available evidence for benefits of brain training and concluded that “the evidence that training with commercial brain-training software can enhance cognition outside the laboratory is limited and inconsistent” (Simons et al., 2016, p. 173). Finally, in a meta-analysis examining brain training in the form of playing video games, Sala, Tatlidil, and Gobet (2017) “found no evidence of a causal relationship between playing video games and enhanced cognitive ability” (p. 111).

Mindset

Whereas the idea of brain training is to directly strengthen cognitive abilities, the aim of mindset interventions is to increase people’s *beliefs* that they can be strengthened. Dweck and colleagues have argued that people who hold a *growth mindset* believe that intelligence (and other traits) can be improved with effort (Dweck, 2000), and thus will persist to overcome obstacles and work hard; by contrast, people with a *fixed mindset* believe intelligence is relatively stable and are “devastated by setbacks” (Dweck, 2008). In a typical mindset intervention, participants are told that the brain is like a muscle and can grow with effort. As Dweck (2007) explained, students learn about “how they can make their brains work better and grow smarter” (p. 38). These brief interventions are touted for “striking effects on educational achievement” (Yeager & Walton, 2011, p. 268; see also Boaler, 2013; Dweck, 2008).

Mindset interventions are used in schools around the world. However, evidence for the impact of mindset on real-world outcomes is equivocal. Large-sample research has failed to

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

replicate findings of beneficial effects of mindset interventions. As a case in point, across three studies with a total sample over 600 participants, Li and Bates (2017) found “no support for mindset-effects on cognitive ability, response to challenge, or educational progress” (p. 2). Furthermore, in a recent meta-analysis, Sisk, Burgoyne, Sun, Butler, and Macnamara (2018) examined the effectiveness of growth mindset interventions on academic achievement and identified a number of methodological shortcomings among mindset studies, such as many instances of manipulation checks either not being successful or not being reported. Sisk et al. found that the effectiveness of mindset interventions on academic achievement was very weak overall, with almost all analyses yielding small or null effects. They concluded that “those seeking more than modest effects or effects for all students are unlikely to find them” (p. 568).

Grit

Grit refers to perseverance and passion for long-term goals (Duckworth & Eskreis-Winkler, 2013; Duckworth, Peterson, Matthews, & Kelly, 2007). Gritty people maintain “effort and interest over years despite failure, adversity, and plateaus in progress” (Duckworth et al., 2007, p. 1088), whereas less gritty people are easily discouraged (Duckworth & Eskreis-Winkler, 2013). Duckworth (2016) argued that “you *can* grow your grit” (p. 269), and Duckworth and Gross (2014) stated they were “optimistic that a better understanding of the psychological processes underlying self-control and grit could, in fact, lead to high-impact, cost-effective interventions” (p. 323).

However, in a study of 4,642 twins, Rimfeld, Kovas, Dale, and Plomin (2016) found that grit was substantially heritable, but found no evidence for a shared environmental influence on grit. Rimfeld et al. explained that “[t]he most limiting finding, for any possible intervention, is that shared environmental influence is negligible” (p. 786). In other words, current

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

environmental factors such as how parents raise their children or approaches schools take to teaching do not appear to influence grit. They also noted that, despite a lack of evidence that grit can be trained, training grit has been established as a priority by the U.S. Department of Education (see <http://edf.stanford.edu/readings/download-promotings-grit-tenacity-andperseverance-report>) and the U.K. Department of Education (see <https://www.gov.uk/government/news/england-to-become-a-globalleader-of-teaching-character>). Rimfeld et al. (2016) caution, "[t]he effectiveness of training programs should be rigorously researched before they are rolled out widely" (p. 781).

Evidence further suggests that, even if grit is found to be trainable, it may have no impact on academic achievement above and beyond other personality factors. For example, Rimfeld et al. (2016) stated that "[g]rit adds little phenotypically or genetically to the prediction of academic achievement beyond traditional personality factors, especially conscientiousness" (p. 780). Similarly, Credé, Tynan, and Harms (2017) conducted a meta-analysis investigating the influence of grit and other traits on academic achievement, and found that while conscientiousness explained variance in academic achievement after controlling for grit, "overall grit explains no variance in either overall academic performance or high school GPA after controlling for conscientiousness" (p. 501).

Deliberate Practice

The concept of deliberate practice emphasizes the importance of environmental factors in the context of acquiring expertise in a specific domain. The deliberate practice view claims that "individual differences in ultimate performance can largely be accounted for by differential amounts of past and current levels of practice" (Ericsson et al, 1993, p. 392). More generally, Ericsson (2007) claimed that "it is possible to account for the development of elite performance

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

among healthy children without recourse to unique talent (genetic endowment)—excepting the innate determinants of body size” (p. 4). A further claim of this view is that “it is impossible for an individual with less accumulated practice at some age to catch up with the best individuals, who have started earlier and maintain maximal levels of deliberate practice not leading to exhaustion” (Ericsson et al., 1993, p. 393).

There is no question that deliberate practice can lead to major improvements in performance within an individual. The controversial claim is that deliberate practice can largely explain differences in performance *across* individuals. This claim is not supported by empirical evidence. In a recent meta-analysis, Macnamara, Hambrick, and Oswald (2014) found that deliberate practice leaves the majority of variance in performance across individuals unexplained and potentially explainable by other factors (see also Platz et al., 2014). In another meta-analysis, Macnamara, Moreau, and Hambrick (2016) found that deliberate practice accounted for a non-significant 1% of the variance in performance among elite-level athletes, inconsistent with Ericsson and colleagues’ (1993) claim that “[i]ndividual differences, even among elite performers, are closely related to assessed amounts of deliberate practice” (p. 363). Furthermore, Macnamara et al. (2016) found that higher-level athletes were no more likely to have begun practicing their sport at a younger age than their lower-level counterparts. Together, this evidence indicates that deliberate practice is not the only important contributor to individual differences in expertise.

Bilingual Advantage

Finally, there is currently a great deal of scientific interest in the benefits of bilingualism for cognitive functioning—the so-called bilingual advantage (Bialystok, 1999). The idea behind the bilingual advantage is that prolonged experience maintaining multiple languages in working

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

memory and inhibiting the inactive language(s) improves executive functioning. As Bialystok (2009) explained, "The effect of bilingualism on cognitive functioning as evidenced by lexical access, executive control, and working memory, is part of a growing body of research demonstrating the powerful role of experience on cognitive function and cognitive organization" (p. 9).

However, multiple researchers have pointed out that the literature on the bilingual advantage research suffers from a high degree of publication bias, favoring statistically significant, positive effects (de Bruin, Treccani, & Della Sala, 2015). Indeed, a recent, large-scale meta-analysis showed no evidence for the bilingual advantage in any executive functioning domain after correcting for publication bias (Lehtonen et al., 2018). Similarly, in a detailed critique of the literature, Paap, Johnson, and Sawi (2015) pointed out that over 80% of the tests assessing the bilingual advantage since 2011 yielded null findings.

What's the Harm?

The evidence that we have just reviewed notwithstanding, one might argue that there is no harm in people believing in the overwhelming importance of environmental factors in success. What, for example, is the harm in leading the elderly to believe that "brain games" will have broad benefits for cognitive functioning, even if that is unlikely given the available evidence? Or what is the harm in enrolling children in mindset interventions (touted as relatively inexpensive), even if the available evidence casts serious doubt on the effectiveness of these interventions?

We think there *is* potential harm in the form of opportunity costs. Some of these opportunity costs impact society. For example, time that students spend completing ineffective interventions could be spent on learning mathematics, science, language, arts, and other school

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

subjects. Similarly, money spent on brain training or mindset programs for a school—even if the program is cheaper than other interventions—could be spent on more effective interventions or on needs such as hiring additional teachers. Other opportunity costs impact science. For example, at the cost of pursuing other areas of research, young scientists excited about these topics might dedicate their formative training years to pursuing effects that they are unlikely to find. Likewise, researchers spending time and effort attempting to reproduce, validate, or meta-analyze these claims do so at the expense of pursuing other research endeavors. Finally, funding dedicated to these areas could go to more promising areas.

We further argue that overemphasizing the role of environmental factors in success may lead to failure being stigmatized, despite the fact that individual differences in many real-world endeavors may in part reflect factors that are not under people's control. That is, by overemphasizing the influence of environmental factors, we may unintentionally hold individuals accountable for conditions, events, or outcomes beyond their control, including learning disabilities and neurological disorders. If, for example, the brain is “like a muscle” and cognitive functions can be dramatically increased through brain training, then why should any child suffer from learning disabilities or ADHD? Likewise, if deliberate practice is the overwhelming determinant of expertise, why should anyone who devotes thousands of hours of practice to a given sport not become an Olympic gold medalist? In short, we argue that overemphasizing malleability while minimizing the role of stable traits in success may burden individuals and families with responsibilities that are largely not theirs to bear.

Conclusion

There is no doubt that environmental factors play an important role in determining success in real-world domains. At the same time, it now seems clear that environmental factors

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

have a more limited impact on individual differences in success than some theories suggest. Views that emphasize malleability over the influence of stable traits on success are appealing, particularly in modern, democratic societies, which place great emphasis on equal opportunities across individuals. However, acknowledging the role of factors that are difficult to change is important, because it enables the allocation of resources where they can have a real impact, taking into account individual needs, to allow meaningful improvements.

In our view, continuing to accept claims that are unsupported by evidence hinders scientific progress and prevents evidence-based policies. The scientific community should therefore consider current evidence and direct research toward endeavors that provide insight on the complex and interacting factors that contribute to individual differences in success in real-world domains. Ultimately, recognizing and understanding individual differences, rather than denying or undermining their importance, leads to politics of equity—providing individuals with the means to thrive—rather than equality—treating everyone uniformly regardless of their specific needs.

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

Recommended Readings

Simons, D. J., Boot, W. R., Charness, N., Gathercole, S. E., Chabris, C. F., Hambrick, D. Z., & Stine-Morrow, E. A. L. (2016). Do “Brain-Training” Programs Work? *Psychological Science in the Public Interest : A Journal of the American Psychological Society*, 17(3), 103–186. <http://doi.org/10.1177/1529100616661983>

This paper reviews evidence for the efficacy of brain training programs, and provides a set of guidelines and best practices the design and reporting of interventions.

Sisk, V., Burgoyne, A., Sun, J., Butler, J., & Macnamara, B. N. (2018). To What Extent and Under Which Circumstances Are Growth Mindsets Important to Academic Achievement? Two Meta-analyses. *Psychological Science*, 29(4), 549-571.

This paper reports on two meta-analyses exploring the relationship between mindset and academic achievement as well as the efficacy of growth mindset interventions in schools.

Credé, M., Tynan, M. C., & Harms, P. D. (2017). Much ado about grit: A meta-analytic synthesis of the grit literature. *Journal of Personality and Social Psychology*, 113(3), 492–511. <http://doi.org/10.1037/pspp0000102>

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This paper reviews the evidence for a bilingual advantage in executive processing, together with a set of three experimental studies investigating the effect via a comparison of bilingual and monolingual populations.

OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

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OVERSTATING ENVIRONMENTAL FACTORS IN SUCCESS

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