NEUROSCIENCE HACKS TO ENHANCE LEARNING AGILITY IN LEADERS

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To help organizations find and nurture leaders to be prepared for the complexity and multiplicity of challenges, Lombardo and Eichinger (2000) developed the framework characterized as learning agility. Their research, along with other colleagues (De Meuse, 2022; De Meuse et al., 2011) have typically identified five dimensions (observable behaviors) to learning agility: mental agility, people agility, change agility, results agility, and self-awareness. Although in the early stages of research, there is a promising body of evidence showing learning agility as a significant predictor of identifying potential leaders, leader performance, and leader success (Burke & Smith, 2019; De Meuse, 2019). This article summarizes the current conceptualization of learning agility, provides a neuroscience lens, and identifies associated key brain structures involved in enhancing learning agility. Specific evidence-based neuroscience hacks for practitioners are introduced to enhance each of those five more popularly cited dimensions of learning agility.

> **What's It Mean? Implications for Consulting Psychology**
> There is a growing body of evidence showing an association between learning agility and leaders' potential, performance, and success (Burke et al., 2016; Burke & Smith, 2019; Dai et al., 2013; De Meuse, 2019). Brain science provides some evidenced-based hacks and strategies for practitioners to enhance learning agility for leaders.

Keywords: learning agility, goal setting, memory, learning, neuroscience

To learn is to gain the ability to do something new, and humans are remarkable learning creatures. Once formed, behavioral preferences and habits can be difficult to change (Nowack, 2017b). However, success often hinges on the ability to do just that: to learn, to adapt, and to change (unlearn and relearn). Those deemed most successful in the workplace, those who make outsized contributions, are more likely to exemplify these abilities. They are often described as *learning agile*.

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Learning agility is of particular interest in organizations because of its application as an indicator of top talent, a predictor of leadership success (De Meuse, 2019), a process to develop leaders (Harvey & Prager, 2021; Heslin & Mellish, 2021; Lee, 2021), and a potential outcome to measure results (Church, 2021; McCauley & Yost, 2021). Many jobs require some level of learning agility, just as many jobs require some level of cognitive intelligence and emotional and social competence. However, the value of learning agility becomes increasingly important to those in more complex roles that are more ambiguous and are associated with more severe consequences (Ruyle, 2021).

Despite the multiple applications of learning agility (e.g., indicator, predictor, process, or outcome), this article aims to explain some of the neuroscience that underpins the five learning-agility dimensions widely studied in research and practice. Additionally, we will provide a set of selected hacks to enhance each dimension, so that practitioners can apply them with their clients. A life hack is any trick, shortcut, skill, or novelty method that accelerates productivity and efficiency. It is essential to note the intention of this article is not to comprehensively describe each of the interrelated brain networks and systems involved with these five core learning-agility dimensions. Nor is it to prescribe all possible hacks on coaching clients to be learning agile, but rather it is to provide an overview of evidence-based suggestions for enhancing learning agility.

An Overview of Learning Agility

Learning agility is a complex, multifaceted construct that encompasses behavioral preferences and skills most associated with rapidly learning from experience and applying that learning to adapt to new, different, and distinctive challenges. As initially defined, learning agility is "the willingness and ability to learn new competencies to perform under first-time, tough, or different conditions" (Lombardo & Eichinger, 2000, p. 323). However, as the construct has developed, so too has its definition to emphasize the importance of speed and flexibility to learn from experience by some researchers (e.g., DeRue et al., 2012). Although cognitive and behavioral processes demonstrate learning agility, how it is demonstrated varies widely among personal attributes (Burke & Smith, 2019; De Meuse, 2022; DeRue et al., 2012; Lombardo & Eichinger, 2000).

Amid the research, there appears to be agreement on three points on the behavioral expressions of learning agility in all employees: (a) seeking and incorporating feedback, (b) taking risks and experimenting, and (c) reflecting on lessons from previous events and experiences. Beyond these three, researchers have expanded these expressions to include (a) exhibiting attitudinal, behavioral, and cognitive flexibility to change; (b) managing uncertainty, ambiguity, and complex situations; and (c) expecting the need for change (Baard et al., 2014; Peterson, 2021).

It is essential to mention that although adaptability, flexibility, and resilience are aspects of learning agility, they are not synonymous with learning agility (De Meuse, 2017). Dai and De Meuse (2021) put forth a preliminary 3 × 3 theoretical model to apply theory to the learning-agility construct. On one axis, they suggest learning agility has three *elements*: the ability to learn, motivation to learn, and the application of learning. On the other axis, they present learning agility as having three *contexts*: cognitive, social, and self-concept. The intersection between the three elements and three learning contexts defines individual attributes more clearly for research and practice, and it prevents learning agility from becoming a vague catch-all construct.

The empirical investigations of the relationships among learning agility, five-factor personality traits, and cognitive-ability measures have been largely inconclusive (Allen, 2016; Dries & Pepermans, 2007; Smith et al., 2017). Factor analysis of the data collected using two older measures of learning agility, Choices Questionnaire (Lombardo & Eichinger, 2000) and viaEDGE (Korn Ferry, 2013–2015), both assessed five dimensions of learning agility: mental agility, people agility, change agility, results agility, and self-awareness. The critical addition to the original four-dimension model (Choices Questionnaire) was the inclusion of self-awareness as a fifth dimension. Self-awareness is "the depth to which an individual knows him- or herself, recognizing skills, strengths, weaknesses, blind spots, and hidden strengths" (De Meuse et al., 2011, p. 7).

The concept of learning agility remains multidimensional, within a broader nomological net of related constructs. Related constructs include goal orientation, openness to experience, cognitive

abilities, and adaptive performance. The definitional boundaries and the theoretical distinctiveness and uniqueness of the learning-agility construct remain to be investigated (DeRue et al., 2012; De Meuse, 2017; Rotolo et al., 2018). Harvey and De Meuse (2021) have updated research and positioned learning agility as a broad psychological construct that captures the diversity and evolving attributes necessary and sufficient to lead talent during stable and changing times.

In their updated learning-agility nomological net, Harvey and De Meuse (2021) described the multitude of factors, mechanisms, behaviors and strategies, environment, and outcomes to stimulate more rigorous and systematic approaches to research. Researchers generally posit learning agility as a single construct. The framework differs, definitions of the dimensions often vary, and the measurements reflect those differences. The current findings on learning agility support existing research and pragmatic frameworks derived from decades of talent-management and coaching work put forth by Lombardo and Eichinger (2000) and have been expanded by others (Burke & Smith, 2019; Harvey & De Meuse, 2021).

Although still in the early stages of research, there is a growing body of evidence showing learning agility as a strong indicator of identifying potential leaders, leader performance, and leader success (Burke et al., 2016; Burke & Smith, 2019; Dai et al., 2013; De Meuse, 2019). Leaders, and those who develop and coach leaders, will particularly benefit from understanding the learning-agility construct and the behavioral preferences and skills that serve leaders in volatile, changing, complex, ambiguous, and high-pressure situations (Ruyle, 2021). For that reason, we focus our attention on neuroscience-based hacks to enhance learning agility for practitioners working with clients, teams, and organizations.

Hacks to Enhance Learning Agility

In this next section, we will provide specific practical hacks based on neuroscience for each of the five learning-agility dimensions. Although not exhaustive, these evidence-based suggestions, recommendations, and techniques have been shown to enhance specific mental, people, change, and results agility, as well as self-awareness to serve as examples for employees, coaches, and consultants. Some hacks may apply to more than one learning-agility dimension, but we have attempted to identify the ones that will most specifically enhance each dimension.

Mental Agility

Mental agility is the extent to which an individual embraces complexity, examines problems in unique and unusual ways, is inquisitive, and can make fresh connections between different concepts. Mentally agile individuals are self-reflective and self-determined. They adopt a play-to-win approach instead of playing out of fear of losing (Wilson & Wilson, 2004). Through mental toughness (Ruparel, 2020), they intentionally place themselves outside of their comfort zones to address work and life demands. Through understanding and managing one's emotions, mentally agile individuals are better able to shift more rapidly from feeling ill at ease to eventually becoming more comfortable (Hardy et al., 2014). Through curiosity, research, and exploration, they can increase knowledge and create future options (Daw et al., 2006). This openness to change and alternative possibilities (one of the Big Five personality factors) helps the learning agile to learn more rapidly and increase their "ability to pick up on things easily" (DeRue et al., 2012, p. 262). The facts and hacks summarized below can enhance the dimension of mental agility.

Identify and Label Emotions

Facts. Mentally agile individuals can build mental toughness, tolerance for ambiguity, and coping with uncomfortable demands, in part, because of their ability to recognize their emotions and feelings as they experience them in new and different situations. It is known that merely labeling an emotional experience with a single word (affect labeling) can reduce self-reported, autonomic, and emotional arousal. Labeling feelings activates areas of the brain (e.g., ventral lateral prefrontal cortex and amygdala) associated with the downregulation of the autonomic fight-or-flight

system (Kircanski et al., 2012; Torre & Lieberman, 2018). Affect labeling allows for accepting or modifying such emotions to cope more effectively with ambiguous and stressful circumstances.

Most typical cognitive-reappraisal strategies involve either reinterpretation or distancing of work and life situations and stressors. Reinterpretation consists in creating an alternative outcome or meaning for a situation (e.g., being mindful that the worst scenario is unlikely to occur). At the same time, distancing involves construing a perspective that increases psychological distance (e.g., viewing a lack of success as a function of the situation rather than one's ability or skills).

A meta-analysis of various emotion-regulation strategies identified cognitive reappraisal, and particularly distancing, as one of the most effective ways to reduce the sympathetic fight-or-flight (HPA, hypothalamic-pituitary-adrenal) response and increase activation of prefrontal cortex regions of the brain associated with greater reasoning and cognitive control (Tabibnia & Radecki, 2018). However, deployment of both strategies requires clients to initially and accurately identify and label one's emotions as they are occurring.

Hacks. Practitioners can assign clients homework to monitor, track, and label emotions throughout a workday to enhance identification and affect labeling. For example, clients can be asked each hour to rate their level of overall stress, identify one or more words to describe their associated emotions and feelings, and evaluate the words as positive or negative in tone. This type of coaching exercise will help to promote mental agility, and as a result it can moderate the autonomic fight-or-flight response.

Another way to enhance mental agility in clients is to introduce and instruct clients to practice several cognitive techniques that facilitate mental toughness and foster the exploration of new ways of thinking about work and life events. These might include: contrasting (compare past stress to the current one, i.e., a significant illness vs. a missed appointment), reflective questioning (asking yourself, "How much will this matter in a year?" or "What's the worst that could happen?" or "How would I survive it?"), and reappraisal strategies to allow clients to look at challenges from a new angle (e.g., "What's an opportunity in this situation I haven't seen?" or "What's a lesson and what can I learn from this situation?"). Clients can be asked to maintain a daily log or weekly journal summarizing how one or more of these mental-agility strategies enhanced the skill of identifying, labeling, and managing emotions.

Encourage Physically Active Microbreaks

Facts. Mentally agile individuals have a capacity to continuously learn and grow utilizing separate neural networks (Oakley & Sejnowski, 2018). Two dominant modes to process information for learning include focusing and diffuse thinking. Focus-based thinking occurs when the brain engages the dorsal attention network (DAN) to highlight specific details intently without distractions and interruptions. On the other hand, diffuse thinking occurs when the default mode network (DMN) is engaged, and the brain shifts to an emphasis on reflection, self-insight, and parasympathetic activation (relaxation response). Diffuse thinking might be much more likely to occur when we allow our mind to wander while taking a walk or doing routine activities such as looking outdoors for a short period of time. Alternating between modes of focused and diffuse thinking increases learning and memory consolidation because it strengthens neural connections (Oakley & Sejnowski, 2018).

One practical way to shift between task-focused and diffuse thinking is to schedule frequent microbreaks into our workday. In two separate studies, several short, voluntary, and impromptu structured breaks in the workday significantly increased self-reported energy level and performance on diverse job-related tasks (Kim et al., 2022). Other research on recovery experiences particularly during lunch breaks (e.g., being mentally disconnected, practicing relaxation techniques, and socializing with others) showed significantly greater confidence, replenishment, and enhanced afternoon work engagement (Bosch et al., 2018).

Hacks. Encourage clients to take frequent microbreaks on the job to enhance performance and mood. Microbreaks involving physical activity have been shown to have a neuroprotective effect on specific brain structures (striatal dopamine receptors) and boost the effectiveness of prefrontal executive function (Tabibnia, 2020). Planned and structured breaks foster mental agility by

toggling and activating main areas of the brain (Boyatzis & Jack, 2018) responsible for planning and doing (task-positive network; TPN) versus reflecting (default mode network; DMN).

Promoting physical activities into a microbreak during work (e.g., at lunch) can significantly improve mood, learning ability, and memory storage (Blomstrand & Engvall, 2021). In general, outdoor activities involving exercise have been shown to significantly increase happiness, positive affect, and meaning/purpose and to decrease mental distress (White et al., 2019). As such, matching specific microbreaks and physical activities at work that are intrinsically motivating to one's client will more likely translate into long-term habit formation and success enhancing mental agility (Nowack, 2017a).

People Agility

People agility is the extent to which one is open-minded toward others; enjoys interacting with a diversity of people; and understands their unique signature strengths, interests, and limitations and uses them effectively to accomplish organizational goals. The agile-learning individual promotes a personal-development practice that brings awareness to the needs and differences of others (specific components of emotional intelligence that involve social understanding and interpersonal skills). By tapping into the richness that diversity in the workplace offers, learning-agile individuals increase team and overall organizational performance (De Meuse, 2019). The following facts and hacks can enhance important aspects of emotional and social competence related to influential people-agility outcomes.

Foster and Enhance Empathy

Facts. Empathy is a critical element of social interactions that allows us to understand and feel others' emotions as well as prompting prosocial behaviors that foster diversity, equity, and inclusion. Morrison et al. (2004) showed that whether experiencing pain personally or through observing others (empathetic distress), the same pattern of brain activity takes place in specific areas of the brain, including the insula (perceived pain), amygdala (emotional regulation), and para-cingulate cortex (theory of mind). Studies confirm that emotional hurt, social rejection, or unfair evaluations from others can trigger the same neurophysiologic pathways associated with physical pain and suffering (Eisenberger et al., 2003).

Research has suggested that in social media and other online platforms, the more positive the social interaction is perceived to be, the less negative affect others will experience (Choi & Kim, 2021). Additionally, expressions of empathetic concern and associated feelings are contagious to other individuals. Emotional contagion is when an individual's emotions or behaviors directly trigger similar emotions and subsequent behaviors in others (Boyatzis & Jack, 2018).

Goleman (2013) outlines an empathy triad that includes cognitive empathy (ability to understand another person's perspective); emotional empathy (the ability to feel what someone else feels); and empathic concern (the ability to sense what another person needs from you fostering prosocial behavior). Each type of empathy has overlapping, but separate, neural pathways (Nowack & Zak, 2020) and can be modified by a variety of lifestyle habits, rituals, and practices. For example, Böckler et al. (2018), using magnetic resonance brain imagery (MRI), found participants who practiced care and compassion-based mindfulness meditation were significantly more generous, willing to help others in need, and showed enhanced cortical thickness in areas supporting these prosocial behaviors.

Hacks. Practitioners should create exercises for clients to consciously interact with diverse groups outside one's predominant social-identity group to facilitate compassion and expand sensitivity of empathetic distress in others. For clients who are open, practitioners can also encourage daily and weekly practice of compassion-based meditation exercises shown to specifically facilitate interpersonal sensitivity, altruistically motivated behavior, and empathy toward others (Böckler et al., 2018). These findings using simple and short mental practices that target qualities of the heart provide some evidence for plasticity in human prosociality—a cornerstone of people agility.

For those consulting and working with teams, fostering the creation and adaption of empathy-oriented norms will help to promote civility, respect, and understanding to enhancing interpersonal trust and psychological safety (Nook et al., 2016; Nowack & Zak, 2020). Additionally, assessing and designing specific programs and interventions addressing the four components of psychological

safety and trust in teams that include: (a) perceived competence/ability; (b) consistency of team-member behavior; (c) displays of caring consideration; and (d) candor, authenticity, and integrity will facilitate team effectiveness and performance (Nowack & Zak, 2021).

Encourage Getting Adequate Sleep

Facts. Sleep deprivation, in general, has also been shown to be associated with diminished emotional expressivity and impaired emotion recognition in others (Beattie et al., 2015). Lack of sleep influences moral decision-making and moderates emotional intelligence (Killgore et al., 2007). For example, leaders who lack emotional intelligence and experience poor sleep while at work experience the most adverse mood and personal-performance deficits compared with those getting adequate sleep (Williams et al., 2013). Conversely, sufficient high-quality sleep has been shown to strengthen emotion regulation, enhancing overall performance and effectiveness on the job (Goldstein & Walker, 2014; Nowack, 2017b; Ong et al., 2016).

Yoo et al. (2007), using functional MRI (fMRI), found one brain area associated with process-ing and managing of emotions (amygdala) became hyperactive in response to negative visual stim-uli in participants who stayed awake for 35 hr straight. However, brain scans of those who got a whole night's sleep in their beds showed regular activity in the amygdala. In their experience, Barnes et al. (2015) examined sleep quality as an antecedent to abusive supervisor behavior. The reporting from both supervisors and their subordinates showed lower sleep-quality ratings of super-visors increased perceived abusive behavior, resulting in significantly lower engagement of employ-ees reporting to them. At the senior level, Nowack (2017b) found that leaders who reported poor quality and quantity of sleep were rated significantly lower on interpersonal effectiveness by their direct reports and peers but not by their managers. This finding is consistent with research suggest-ing that sleep-deprived leaders are more likely to use passive-avoidant leadership styles versus more positive transformational or transactional styles with direct reports (Olsen et al., 2016). Together, these studies argue the importance of sleep being associated with people agility.

Hacks. Educating clients about the myth of burning the midnight oil or working long hours without adequate rest and sleep at night can directly enhance productivity, performance, mood, interpersonal effectiveness, and well-being (Nowack, 2017b). Practitioners should encourage clients to obtain enough quality sleep, so they are not inappropriately sleepy the next day (typically, 7 to 9 hr per night). Clients can use evidence-based sleep-hygiene behaviors to establish healthy sleep hab-its. Some healthy habits include regulating light, temperature, and noise; going to bed and rising at the same time each day; removing all electronic devices from the bedrooms; and avoiding meals, caffeine, and alcohol immediately before bedtime.

Additionally, clients should be encouraged to utilize daily power naps (another form of a micro-breaks) to refresh and sharpen concentration, focus, and energy. A NASA study found that up to a 26-min nap improved performance by 34% and alertness by 54% (Rosekind et al., 1995). Finally, practitioners can suggest that their clients consider using popular apps, watches, and other electronic devices on a nightly basis to track and monitor sleep quality.

Change Agility

Change agility is a dimension of learning agility defined as the extent to which an individual responds favorably to change, continuously explores new options and solutions, and is interested in individual and organizational change efforts. Personal openness to change promotes unlearning and relearning within and across the brain (Dance, 2020) and work and life situations, resulting in enhanced performance over time (DeRue et al., 2012). A set of core beliefs that one has some con-trol over change (e.g., optimistic explanatory style and internal locus of control) and the ability to deploy effective coping strategies (self-efficacy) will factor in a client's overall adaptability with life adversity and challenge. Those described as *change agile* are typically resilient (conceptualized as the ability to bounce back emotionally and physically in the face of adversity) and have a cogni-tive predisposition of hardiness in which they perceive work and life change as a challenge instead of a threat, successfully enhancing their change agility (Nowack & Niemirowski, 2021).

Facilitate Cognitive Hardiness

Facts. Cognitive hardiness was initially conceptualized as a moderately stable personality characteristic supportive of positive outcomes to negative life situations, stressors, and events (Bartone, 1999; Kobasa, 1979). As such, individuals who are hardy possess a stable set of appraisals and coping strategies to translate stressful work and life circumstances into opportunities for development or growth. The hardiness construct was originally conceived with three cognitive dispositional tendencies: (a) a strong belief in personal control or influence over events and experiences, (b) a feeling of deep commitment or involvement in life's activities, and (c) viewing change as an exciting challenge or a perceived threat (Kobasa, 1979).

The construct of hardiness has been included in various coaching, organizational-psychology, and health-psychology studies, but there continues to be confusion in the coaching literature about its uniqueness given the overlap in similarly labeled constructs (e.g., resilience, grit, mental toughness) and various scales (Nowack & Niemirowski, 2021). For example, one of the main differences between cognitive hardiness and resilience, at the measurement level, is that cognitive hardiness tends to have a concrete theoretical model both in terms of structure and rationale, whereas resilience can be conceptualized either as the ability to resist damage by trauma or a measure of actual recovery from such traumas (Infurna & Jayawickreme, 2019). A growing number of studies provide some support for the argument that resilience in general and cognitive hardiness as a constellation of cognitions, emotions, and behaviors can be modified by structured executive coaching and psychoeducational programs.

Tabibnia (2020) summarized three neurobiological approaches to boost resilience and hardiness, including: (a) down-regulating the negative (fight-or-flight response); (b) up-regulating the positive; and (c) transcending self. Down-regulating the negative includes behavioral and cognitive coping strategies that reduce distress-related responses to the brain regions (amygdala, HPA, and anatomic nervous system). Through active avoidance (moving away from a predictor of stress), the medial prefrontal cortex (MPFC) is recruited to suppress the fear response and enhance active coping strategies.

The up-regulating positive neural pathway includes activating the mesostriatal reward network. Up-regulating can occur through such behaviors as smiling or sharing humor. Whether voluntary or involuntary, the mere forming of a smile activates the brain (striatum, mPFC, and amygdala) to positively affect stressful experiences and lower heart rate during stress recovery (Kraft & Pressman, 2012). Transcending self can be accomplished through a variety of techniques and strategies such as clarifying purpose in life, acting on religious beliefs, and embracing spiritual practices and rituals (Tabibnia, 2020). Such strategies appear to directly activate several important task and emotion-related areas of the brain, including the DMN and reward-related regions.

Hacks. Unpacking each of the three underlying dispositions of cognitive hardiness (commitment, challenge, and control) provides some guidance for coaches about ways to enhance hardiness with their clients. Regarding the commitment disposition underlying cognitive hardiness, practitioners who utilize a strength-based approach (Burke & Passmore, 2019) might increase client commitment to goal setting and behavior change by identifying and encouraging use of their client's signature strengths with positive performance and well-being outcomes. In a six-group, random assignment, placebo-controlled prospective study, Seligman et al. (2005) demonstrated that deployment of signature strengths facilitated a significant increase in overall happiness and decreased depressive symptoms that lasted for approximately 3 months.

With respect to addressing the challenge disposition of cognitive hardiness, coaches should focus client's attention to learning versus performance-based goals (Nowack, 2017b) and emphasize a growth-based mind-set versus fixed-based mind-set (Dweck & Yeager, 2019). A growth-based mind-set is the belief that individual capacities are not entirely fixed but can be enhanced and developed over time. Dweck and colleagues have shown that people who believe or are taught that abilities are malleable (growth mind-set) rather than immutable (fixed mind-set) tend to learn better and improve more (Yeager et al., 2019).

When clients are experiencing a lack of control over work and life events, practitioners can help clients facilitate a sense of purpose, meaning, and gratitude-giving to minimize the impact of stressors on well-being. A study by Alimujiang et al. (2019) found in a study of 6,985 adults that life purpose significantly predicted physical health, psychological well-being, and longevity. Their findings suggest that clarifying and defining legacy, purpose, and meaning with clients may enhance perceived control over life events and facilitate change agility. Finally, reflecting on one's own blessings and outwardly expressing gratitude toward others has a positive effect on numerous related brain regions (e.g., medial prefrontal cortex) that reduces distress and enhances overall psychological and physical well-being (Kaczmarek et al., 2015; Seligman et al., 2005).

Normalize the Behavior of Quitting (Some) Goals

Facts. The popular concept of grit (Duckworth et al., 2007) has reinforced a never-quit philosophy despite evidence of only modest associations with diverse performance and retention outcomes. A meta-analysis found that grit, as typically measured, moderately correlated with various performance and retention outcomes and strongly associated with the construct of perseverance and conscientiousness (Credé et al., 2017). Persevering when faced with prolonged goal setbacks and obstacles could appear to be helpful for successful change efforts and organizational goal attainment (i.e., holding). However, the cost of the pursuers' mental health might not be worth it, especially when the goals are not self-generated or are only to please others.

According to several studies, quitting (folding) may be a better coping strategy for the well-being of some clients faced with unattainable goals or when they pursue change out of obligation or pressure (internal or external). Experiencing decisional conflict between pursuing a goal or letting it go was significantly associated with increased levels of cortisol, perceived stress, poor health, and depression symptoms (Holding et al., 2021). In a series of studies, psychologists Gregory Miller and Carsten Wrosch found people who feel comfortable quitting when faced with unattainable goals may have better mental and physical health than those who persevere and push themselves to succeed (Wrosch et al., 2013, 2003, 2007). Additional research showed that those persistent individuals experienced higher levels of an inflammatory protein called *C-reactive protein* (an indicator of inflammation) as well as increased cortisol (Miller & Wrosch, 2007).

Hacks. It is important to support clients when personal and professional goals become unattainable to pivot to or give up entirely rather than pressing on. The inability to disengage from unrealistic and unattainable change initiatives or goals can have significant downstream physiological consequences in the brain and the body (Miller & Wrosch, 2007). Despite the popularity of the notion of persistence acclaimed in both academic and popular publications, it sometimes is advisable to encourage client to walk away, redefine their goals, divide them into smaller steps, or seek creative alternatives. Indeed, folding at appropriate times for clients can be a counterintuitive critical hack related to successful change-agility outcomes.

Results Agility

Results agility is a dimension of learning agility defined as the extent to which an individual is motivated by challenge while delivering results through resourcefulness and inspiring others. Those who are high results-agile are more comfortable than others in coping with perceived physical and psychological threats. They continually explore and expand their comfort zones, so over time they find themselves confident and at ease with what was perceived as uncertainty (De Meuse, 2019). Because we associate skill level with comfort level (i.e., we are comfortable doing what we do well), results-agile leaders show greater skills and achieve higher performance when faced with a wide range of work and life challenges. The following facts and hacks offer ways for leaders to enhance a results mind-set consistent with successful results-agility outcomes.

Visualize Results to Enhance Skills and Performance

Facts. The role of mental practice (MP) or rehearsal of behaviors toward specific results is an effective technique to enhance neuroplasticity, emotional regulation, and task performance (Skottnik

& Linden, 2019). Most athletes, musicians, and surgeons benefit from MP by visualizing or mentally rehearsing a motor task without the corresponding physical movement (Driskell et al., 1994; Munzert et al., 2009). MP is a distinct mental preparatory behavior that includes additional positive imagery, visual imagery, relaxation techniques, and attention focusing (Kappes & Morewedge, 2016). It involves a network of brain areas from the frontal cortex to sensory areas overlapping with the DMN associated with learning and openness-to-change behavior (Boyatzis & Jack, 2018).

Pascual-Leone et al. (2005) used transcranial magnetic stimulation (TMS) to study the role of changes in the motor cortex of the human brain in acquiring new fine motor skills learning a five-fingered exercise on the piano. After five consecutive days of 2-hr practice sessions, the participants were assigned into two groups, those who continued physically practicing and those who mentally simulated practicing. Their finding showed the MP participants resulted in a nearly identical reorganization of the motor outputs as the participants who physically practiced the finger movements on the piano. This study was one of the first to show that behavioral and mental rehearsal directly strengthens neural-motor pathways with associated performance improvements and appear to transfer to similar motor skills required for future tasks.

Woollett et al. (2009) used neuroimaging to study the neural changes in London taxi drivers given the requirement for exceptional memory, ability to navigate, and learning of over 25,000 city streets. The taxi drivers and nontaxi drivers equally activated a key memory area of the brain (hippocampus) during a navigation and scanning procedure, but only taxi drivers demonstrated significantly greater gray-matter volume in the hippocampus. They further explored structural brain changes in retired drivers compared with full-time drivers.

The authors found that full-time drivers had significantly greater gray-matter volume in the posterior hippocampus than retired taxi drivers, who had greater volume in this region than the control participants, who were retired nontaxi drivers. This study provided preliminary evidence for plasticity of the brain (hippocampus) in both directions—during the acquisition of new skills or in habit formation and again when the behavior ceases. The importance of this aspect of neuroplasticity (use it, lose it) has implications for driving learning-agility results, as well.

Hacks. Practitioners should utilize diverse MP exercises during individual coaching meetings and postsession follow-up assignments to increase automaticity and new habit formation. Clients should become aware that acquiring and becoming proficient in new skills requires rewiring the brain and results from deliberate, structured practice ("Neurons that fire together gets wired together"). At a brain level, neuroplasticity includes two things: (a) neurogenesis (the growth of new neurons) and (b) synaptogenesis (new connections between neurons).

Structured mental rehearsal exercises focusing on specific skills clients want to sharpen and improve must be performed on a regular basis throughout a coaching engagement. Research by Lally et al. (2010) suggested it takes 66 days, on average, for new behaviors to become automatic and natural. Mainly when clients are under pressure and stress, it is easy to abandon their practice of newly acquired behaviors (Boyatzis & Jack, 2018). As a result, putting into place feedforward monitoring and evaluation of ongoing goal success as well as sustained behavior change over time will also enhance successful results agility outcomes.

Foster Successful Goal Setting and Goal Striving

Facts. Berkman (2018) colloquially referred to a goal as any desired outcome that would not otherwise happen without intervention but suggested that two neural pathways are involved in successful goal accomplishment. These two separate neural circuits include the will (initiation and motivation) and the way (goals, plans, and success). The will is based on the strength of the desire (motivation) to attain specific outcomes regardless of how unpleasant or pleasant the experience to achieve it is. To get started on a goal or initiate a habit, change activates the mesolimbic dopaminergic neurons, particularly within the ventral striatum and ventromedial prefrontal cortex (vmPFC).

The neuroscience of motivation suggests that new behaviors are rarely as motivating as existing ones previously rewarded (mesostriatal reward network). The way refers to the cognitive and informational aspects of behavior change and transferring habits into lasting goals, which requires integrating brain activity (TPNs), including the ventrolateral prefrontal cortex, dorsal anterior cingulate

cortex, parietal cortex, and temporoparietal junction). It is important to note that wanting to change, often observed as stating intentions through goals, does not necessarily ensure or strongly predict successful change in your clients (Nowack, 2017a).

Hacks.   Motivation is intertwined with reward (mesostriatal reward network), and a reward value, in turn, is intimately influenced by experience. Linking personal reward (e.g., monetary or pleasurable activity) with successful implementation helps activate the mesostriatal reward networks to help reinforce future practice and goal success (Tabibnia, 2020). Encourage clients to focus, track, and monitor what they have completed (i.e., progress made) at the very beginning of the goal or outcomes pursuit to maximize motivation, then shift attention toward what is left to accomplish as goal completion becomes more realistic (Bonezzi et al., 2011).

Practitioners should suggest that clients utilize if-then implementation intentions as a form of goal setting to leverage goal achievement and success (Nowack, 2017b). Implementation intentions have several parts to activate the task-positive or executive brain networks: (a) a trigger or cue such as the time of day or a situation (if) and (b) specific behavior to be practiced (then) combined with a meaningful personal reward. The implementation intentions (practice plans that include triggers, specific behaviors to focus on, and personal reward) double a client's likelihood of achieving their goals or outcomes (Gollwitzer & Sheeran, 2006).

Self-Awareness

Self-awareness is a dimension of learning agility defined as the extent to which a client has personal insight, clearly understands his or her strengths and weaknesses and blind spots, and uses this knowledge to perform more effectively. When clients can identify their signature strengths and potential development areas and can accurately define how others experience their behavior (reputation), they can respond intelligently to a changing environment and actively seek feedback without being defensive (Wheatley, 2006). Accurate self-insight facilitates effective coping with work and life stressors by reducing the distress-induced regions of the brain such as the sympathetic-adrenal-medullary (SAM) and HPA systems (Tabibnia, 2020). We offer several facts and hacks that can directly enhance your clients' accurate self-insight and self-awareness within coaching engagements.

Facilitate Staying in the Moment

Facts.   Attention and consciousness are closely related. Attention implies an awareness, consciousness, of that to which one is attending (i.e., internal and external awareness). Attention intensifies the individual experience and causes neurons associated with the experience to fire repeatedly, an initial and necessary step in any learning process. The more we give our attention to an event, the stronger the memory remains and becomes anchored in our long-term memory and retrieval systems. This anchoring further encodes information in specific areas of the brain such as the medial prefrontal cortex (mPFC) and is recalled in future situations (McDonald & Mott, 2017).

Attention is essential to learning and learning agility because it (a) creates awareness of one's emotional state, to what one finds threatening and rewarding, and raises consciousness of the boundaries of one's comfort zones; (b) provides focus to practice and to review the lessons embedded in experiences, so they are consolidated into long-term memory; and (c) creates sensitivity to cues that stimulate recall of lessons learned.

Hacks.   Practitioners can encourage their clients to engage in homework assignments to practice attention-based mindfulness meditation frequently to enhance focus, concentration, and self-awareness. Attention-based meditation training demonstrably and specifically improves attentional skills and might be the most effective attention-based training method available to improve emotional regulation. For example, Hölzel et al. (2011) observed significant structural changes in gray-matter concentration within the hippocampus within a period of only 8 weeks of practice compared with control participants. The results suggest that use of mindfulness-based meditation practices is associated with structural changes in brain regions involved in learning and memory processes, emotion regulation, and perspective-taking.

Additionally, clients who are mindful and self-aware more easily can move into a flow state with work and nonwork activities and tasks. Flow is a state of mind in which a client is fully immersed in activities but cognitively involved and mentally focused on what they are doing, optimizing performance and results. When in a flow state, the DMN is fully activated and there is a downregulation of the autonomic stress response (Csikszentmihályi, 1999; Nakamura & Csikszentmihalyi, 2009).

Flow is associated with reduced negative affect, a boost in positive affect, and an increase in the parasympathetic relaxation response. Practitioners can help clients successfully move more rapidly into flow states by helping them to: (a) identify tasks and activities in which they perceive losing a sense of time; (b) making a list of things that create interruptions during work activities and ways to avoid or cope with them to get back to the task at hand; (c) maintaining a daily journal to record physical and emotional reactions that successfully lead into flow states; and (d) utilizing attention-based meditative exercises to enhance conscious focus on bodily sensations, thoughts, and feelings (Tabibnia, 2020).

Disclose and Express Emotions

Facts. Disclosing emotions, such as through expressive writing about one's stressful experiences for 15 to 20 min, can improve both short-term and long-term well-being (Pennebaker, 1997). Expressive writing has been shown to reduce symptoms of anxiety and depression, improve immune functioning, reduce physical stress, and enhance cognitive functioning by helping clients gain a new perspective on a difficult situation (Saldanha & Barclay, 2021). Although the mechanisms underlying the effectiveness of emotion disclosure is not fully known, it does appear to be positively associated with reappraisal, distancing, and enhancement of self-efficacy. Disclosing emotions also appears to facilitate the transfer of emotional processing from areas of the brain associated with fear and arousal (e.g., reactive limbic systems) to the prefrontal cortex associated with reasoning and logic (e.g., parasympathetic systems), thus, deactivating the stress circuits (Bourassa et al., 2017).

Previous research has shown that individuals who demonstrate a tendency to inhibit the experience and expression of feelings (repressive coping) show physiological reactions (e.g., cardiac reactivity, increased skin conductance) that are not compatible with subjective ratings of distress. As such, those repressing and unable to disclose and express their feelings are more likely to experience poor health and somatic illness such as cancer and coronary heart disease (Mund & Mitte, 2012).

Hacks. Clients can be asked to participate in an emotional expressive-writing assignment, selecting a stress-inducing work situation, interpersonal conflict, or an experience of discrimination, inequity, or unfairness. Clients typically will be instructed to spend around 15 to 20 min a day for 3 to 5 days writing about one's deepest feelings and emotions related to an event or interaction they have had, without regard to grammar, punctuation, or spelling.

Clients are given permission to link their writing to who they have been (past self) and who they would like to become in the future (future self) or who they are now (current self). Practitioners can process the outcomes of this exercise with their clients to facilitate self-awareness, reappraisal of the situation, emotional distancing, and coping techniques to manage anticipated future work challenges.

Clarifying a Future-Focused and Ideal Self

Facts. Accuracy of knowing one's skills and abilities relative to others is a valuable way to conceptualize and define accurate self-awareness (Nowack, 2009). Research supports a significant association of self-awareness or self-insight, a core component of emotional and social competence, with individual and team performance (Bratton et al., 2011; Dierdorff & Rubin, 2015; Krén & Séllei, 2021). Understanding, respecting, meditating, accepting, and acting on feedback provided by the perceptions of self and others are important motivators for enhancing self-insight, ideal self, and future performance.

However, feedback often elicits a kind of social-evaluative threat associated with larger cortisol and ambulatory blood-pressure responses (Dickerson & Kemeny, 2004; Lehman & Conley, 2010). One explanation is that feedback focused on the past is recalled consistently better than feedback

focused on the future (Nash et al., 2018). Recalling past feedback elicits socially more significant pain than future-focused feedback (Chen et al., 2008). Although we can recall feedback focused on the past greater than future focus, it is the future-focused feedback that is the strongest predictor of acceptance and motivation to change behavior (Gnepp et al., 2020).

Intentional change theory (ICT) suggests that people are more likely to consider a change in habits and behavior when intrinsically motivated and engaging a person's ideal self or personal vision (see visioning results) of the future (Boyatzis & Akrivou, 2006). Research has shown the parasympathetic system and the DMN are activated when focusing on one's vision of their ideal (Boyatzis & Jack, 2018). The DMN and the vmPFC (memory, social cognition, self-perception, etc.) have a crucial role in regulating our emotions, specifically in regulating fear of perceived work and life challenges. When we are anxious and fearful, we are motivated to act and explore coping strategies while activating other brain areas such as the TPN and our client's fight or flight sympathetic system.

Hacks. Practitioners working with clients in a leadership role should remind them of research that indicates that positively focused feedback is much more motivating to lesser skilled and experienced employees at the beginning of goal setting, when they are learning new knowledge or skills, and in less close interpersonal relationships (Schroeder & Fishbach, 2015). On the other hand, future-oriented feedforward is experienced as more motivating and useful for employees who are already competent and experienced and looking for more detailed suggestions, toward the end of goal accomplishment, and with those that have more intimate and close relationships (Touré-Tillery & Fishbach, 2011).

In coaching sessions with clients, practitioners can facilitate exploration and discussion of the self-perceived gap between the ideal versus current self. By translating this vision of what a client wants to become in the future, they are better able to effectively cope with the stress of change and be more motivated to set personal and professional goals to facilitate their growth and development. Because intrinsic motives predict goal success more strongly than extrinsic ones, the ideal self is a key emotional driver for intentional change in clients (Boyatzis & Akrivou, 2006; Boyatzis et al., 2015).

The Neuroscience of Learning Agility: The Road Ahead

Learning agility's humble beginnings trace back to trying to answer some of the following questions: What is a high potential? How do you identify a high potential? How do you coach someone to become a high potential? (Lombardo & Eichinger, 2000). Fast forward more than 20 years, and we find learning agility has evolved into a robust, multidimensional psychological construct that provides direction to identify top talent, predict top talent, and help leaders become more effective at leading individuals and teams. Table 1 summarizes some of the most evidence-based hacks associated with each of five dimensions of learning agility.

A proliferation of brain-based research has been made possible by advances in both theory and technology (e.g., brain imagery, wearable technology). Although we present the most evidence-based research findings to date, many studies will likely not be replicated in the future, and new findings may likely expand and even contradict the efficacy of some of our recommended hacks. Additionally, it is important to note that the current findings of recent neuroscience-based research may not be as generalizable, given how changeable and diverse organizations have become (Dotson & Duarte, 2020). The advancement of the conceptualization, measurement, and utility of learning agility in the future undoubtedly will evolve as future research includes more diverse samples with respect to gender and more racially and ethnically homogeneous samples. Although it might be challenging to gather a large enough samples size for statistical power, that information alone is informative in helping answer the first two founding questions: What is a high potential? How do you identify a high potential?

Additionally, future learning-agility research requires a focus on more longitudinal studies, such as those of Dai et al. (2013) and others. It is important to note that the neural underpinning of human-cognition research is likely not as generalizable as it once was, given how much more diverse our organizations have become (Dotson & Duarte, 2020). Such prospective studies should include first-time managers to identify high or low learning agility and track the trajectory of their

Table 1
Summary of Learning Agility Factors, Hacks, and Associated Brain Regions

Learning-agility factors	Hack	Brain region	Example references
Mental agility	Identify and label emotions	Ventral lateral prefrontal cortex; amygdala; hypothalamic-pituitary-adrenal (HPA); prefrontal cortex; sympathetic nervous system (SNS)	Kircanski et al. (2012); Tabibnia and Radecki (2018); Torre and Lieberman (2018)
	Encourage physically active microbreaks	Dorsal attention network (DAN); default mode network (DMN); striatal dopamine receptors; task-positive network (TPN)	Blomstrand and Engvall (2021); Boyatzis and Jack (2018); Kim et al. (2022); Nowack (2017a); Oakley and Sejnowski (2018); Tabibnia (2020); White et al. (2019)
People agility	Foster and enhance empathy	Insula; amygdala; para-cingulate cortex; neurophysiological pathways	Böckler et al. (2018); Boyatzis and Jack (2018); Choi and Kim (2021); Eisenberger et al. (2003); Goleman (2013); Morrison et al. (2004); Nook et al. (2016); Nowack and Zak (2020, 2021)
	Encourage getting adequate sleep	Amygdala	Beattie et al. (2015); Goldstein and Walker (2014); Killgore et al. (2007); Nowack (2017b); Ong et al. (2016); Williams et al. (2013); Yoo et al. (2007)
Change agility	Facilitate cognitive hardiness	Amygdala, HPA; anatomic nervous system; medial prefrontal cortex (MPFC); mesostriatal reward network; striatum; DMN	Alimujiang et al. (2019); Bartone (1999); Dweck and Yeager (2019); Infurna and Jayawickreme (2019); Kaczmarek et al. (2015); Kobasa (1979); Kraft and Pressman (2012); Nowack (2017b); Nowack and Niemirowski (2021); Seligman et al. (2005); Tabibnia (2020); Yeager et al. (2019)
	Normalize the behavior of quitting (some) goals	C-reactive protein; cortisol	Credé et al. (2017); Duckworth et al. (2007); Holding et al. (2021); Miller and Wrosch (2007); Wrosch et al. (2013, 2003, 2007)
Results agility	Visualize results to enhance skills and performance	Frontal cortex; DMN; motor cortex; hippocampus; neuroplasticity; neurogenesis	Boyatzis and Jack (2018); Driskell et al. (1994); Kappes and Morewedge (2016); Lally et al. (2010); Munzert et al. (2009); Pascual-Leone et al. (2005); Skottnik and Linden (2019); Woollett et al. (2009);
	Foster successful goal setting and goal striving	Ventral striatum; ventromedial prefrontal cortex (vmPFC); mesostriatal reward network; TPN; doral	Berkman (2018); Bonezzi et al. (2011); Gollwitzer and Sheeran (2006); Nowack (2017a); Tabibnia (2020)

(table continues)

Table 1 (*continued*)

Learning-agility factors	Hack	Brain region	Example references
Self-awareness		anterior cingulate cortex; parietal cortex; temporo-parietal junction	Csikszentmihályi (1999); Hölzel et al. (2011); McDonald and Mott (2017); Nakamura and Csikszentmihalyi (2009); Tabibnia (2020)
	Facilitate staying in the moment	Sympathetic-adrenal-medullary (SAM); HPA; mPFC; gray matter; hippocampus; parasympathetic nervous system (PNS)	
	Disclose and express emotions	Limbic system; PFC; PNS	Bourassa et al. (2017); Mund and Mitte (2012); Pennebaker (1997); Saldanha and Barclay (2021)
	Clarifying a future-focused and ideal self	Cortisol; ambulatory blood pressure; PNS; DMN; vmPFC; TPN; SNS	Boyatzis and Jack (2018); Boyatzis et al. (2015); Bratton et al. (2011); Chen et al. (2008); Dickerson and Kemeny (2004); Dierdorff and Rubin (2015); Gnepp et al. (2020); Krén and Séllei (2021); Lehman and Conley (2010); Nash et al. (2018); Nowack (2009); Schroeder and Fishbach (2015); Touré-Tillery and Fishbach (2011)

careers over 5 to 10 years, or longer if possible. Each of the five learning-agility dimensions requires more randomly controlled intervention studies to explore for whom and under what conditions agility can be enhanced. Additionally, research on learning agility should expand samples drawn from populations that are White, educated, industrialized, rich, and democratic (sometime indicated by the acroynym *WEIRD*) to enhance clarification and generalization of findings in the future.

As Hezlett and Kuncel (2012) point out, future research on the learning-agility dimensions will likely lead to further refinement to avoid a potentially useful concept from becoming just another hot topic in consulting psychology that ultimately fades from use. These authors argue that future research should focus on three areas to strengthen or refute the current research results and clarify the practical utility of the five dimensions of learning agility summarized in this article. These include: (a) What does learning agility predict, incrementally, beyond cognitive ability, personality, and other known psychological constructs such as cognitive flexibility (Braem & Egner, 2018)? (b) How is learning agility similar and distinct from other psychological constructs? (c) What influences the development and enhancement of learning agility in the different learning-agility assessments, models, and dimensions?

Finally, additional replication studies summarized in this article for each of the various neuroscience hacks are required to ensure sound techniques enhance learning agility. Despite the marketing hyperbole and neuroscience-based "mythconceptions" (Nowack & Radecki, 2018), the research behind these hacks can help consulting psychologists working with their clients. Because the human brain can continue learning given the right environment, practitioners are encouraged to use the different hacks to elicit and engage the client's ideal self and motivation to facilitate successful behavioral changes within coaching engagements and development-based training programs.

Conclusion

Although 366 billion dollars are spent annually on global leadership development (Westfall, 2019), the return on investment with regards to creating psychologically safe, trusting, and engaging corporate cultures where employees can flourish remains variable. With regards to leaders, it is estimated that 40% of those identified as high potentials fail in current roles (Martin & Schmidt, 2010), 70% of high performers lack the critical skills to succeed in future roles (Martin & Schmidt, 2010), and one out of every two leaders is ineffective or incompetent (Hogan et al., 2011). In a world that continues to be volatile, uncertain, complex, and ambiguous, learning agility is becoming increasingly essential to make sense of our rapidly changing business environments, the dynamic economy, ever-evolving technology, and global interconnectedness (Peterson, 2021). Neuroscience can continue to provide some targeted evidence-based hacks, strategies, techniques, and suggestions for enhancing each of the five core dimensions of learning agility.

It is expected that some of the five most popular dimensions of learning agility will continue to evolve in concept, measurement, and application for specific individual, team, and organizational outcomes. Future research will be required to determine the incremental validity of one or more of these five dimensions, and it is likely that a revision or consolidation, or both, of the learning-agility model will likely emerge and continue to be refined. In the meantime, those who seek to develop and coach leaders by strengthening their learning agility can benefit from using the neuroscience-based hacks summarized in this article. And for those who want to make outsized contributions in the practice and research of learning agility, hack on!

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