The Healthy Mind Platter

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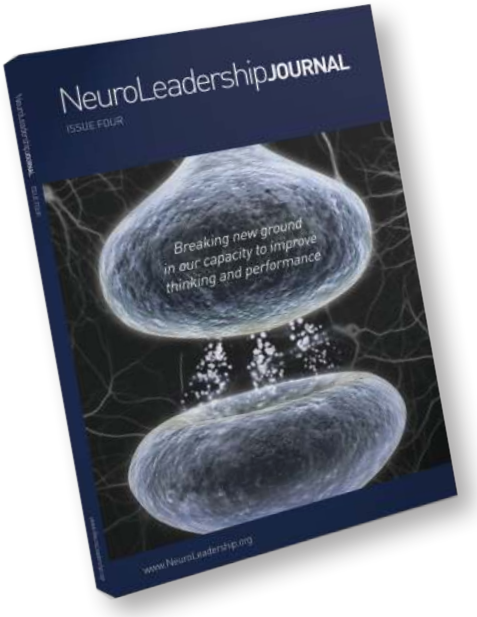

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The last few decades have witnessed a growing awareness of the importance of nutrition as a basis for health within the general population. In the U.S. and Europe, governments have created nutrition recommendations. Published as charts, such as healthy food pyramids, which indicate that different food groups provide important nutrients, they recommend that citizens follow a "complete" diet that provides all the essentials the body needs. Because the body needs a wide variety of ingredients for optimal health, the basic underlying principles are variation and complementarity. This suggests that always eating the same food, even if it is healthy, does not provide the body with a wide enough variety of ingredients for optimal health.

Spurred on in 2011 by the U.S. Government's relaunch of the food pyramid as a 'healthy eating plate', the authors Daniel Siegel and David Rock decided to explore a framework for understanding the ideal diet for our brain. We decided to coin this the "Healthy Mind Platter". We do not refer literally to substances like glucose, which is an essential nutrient for the functioning of the brain, but to a set of everyday activities that on the whole, optimize "brain health". Based on our literature review, we hypothesize that there are seven activities that each have different and beneficial effects on the mind that complement each other, providing together a well-balanced "mental diet" for optimal neurocognitive functioning and well-being. We propose that very much as in the case of food, people can do without some of these activities, but this lack of behavior will be associated with sub-optimal levels of functioning or ill-health. Further research is needed to determine the exact quantity and quality of each activity that is needed for optimal health, but we propose that each of these activities makes a unique and positive contribution to mental productivity and wellbeing. As such, the objective of the Healthy Mind Platter is *to propose a framework for creating and maintaining mental well-being, summarizing and integrating distinct strands of neuroscience and psychology research, so it can be used to inform communities such as schools, organizations, governments, and communities, as well as families and individuals, about best practices for promoting mental health*.

Introduction

Throughout the world, driven by advances in information technology and automation, our economy is gradually shifting to a knowledge- and service-driven economy, where increasingly the basic production factor of muscle power is being replaced by brain-power. Although often compared to a muscle, the brain's anatomy and physiology is fundamentally different from those of muscles. Whereas a combination of exercise, rest and nutrition can be sufficient to produce physical strength and resilience, these are clearly not sufficient conditions for an alert, creative and resilient mind. In line with the principles and purpose of positive psychology, we want to move beyond studying and summarizing what is needed to avoid pathology, and make clear and useful what is needed to promote health. Though awareness of how an unhealthy diet can result in serious pathologies and epidemics, like obesity, is now being raised, many are hardly aware of the costs of an unhealthy mental diet, like massive losses in productivity, exhaustion, burn-out, and stress. Explicating the constituent activities for a healthy mind is therefore timely and important, especially since developed countries are reaching the limits of economic growth.

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One may daily observe on the news the catastrophic consequences of being deprived of food and basic housing, but society is relatively unaware of what happens when individuals or large communities are deprived of play (think of entire generations of children working under conditions of forced labor), good quality sleep (think of the vast amount of people regularly taking sleep medications), or satisfying time to focus and sustain clear attention without distraction (think of population groups suffering unemployment or underemployment, or the vast number of people who fill their time with junk media).

Most members of the general population know little about how the constant interruptions and distractions caused by communication devices and the bombardment of information and publicity sent out by the media impacts our mental well-being. They have minimal awareness of the negative effects of the sense of isolation and lack of relatedness that can occur in large cities that are built without regard for our need for a sense of community. Finally, what we have to gain as a species from the generalized practice of reflective practices is not readily apparent to the general population unaware of the research pointing to its positive impacts.

With stress, the brain will disconnect more often from the task at hand, and we may find ourselves staring at the computer screen, experiencing a momentary state of reverie or trance.

Consider the current state of how most people manage – cultivate and maintain – their mental well-being. We have all experienced the challenge of maintaining focus over prolonged periods of time, and know how it can cause fatigue. We all know that our attention is even more limited if we had little sleep the night before. With stress, the brain will disconnect more often from the task at hand, and we may find ourselves staring at the computer screen, experiencing a momentary state of reverie or trance. As soon as we become aware of our disconnection, we may want to return to the task, but we might feel an urge to stand up, go for a walk and get a snack. Basically, our brain is demanding a minimum level of physical motion and important nutrients in order to be able to operate well. On our way to the vending machine we may encounter a colleague, and although we are cognizant of the pile of work waiting for us on our desk, we connect with a bystander to exchange a chat and a joke.

Following a healthy mind diet can provide us with the physical and mental well-being necessary to establish and maintain relationships with family, friends and colleagues...

Once again, our brain is automatically driving us to socialize even without our awareness or conscious intention, distracting us, and delaying the time before we return to work. Once we are back at our desk we may be able to focus again, but we seem to lack the necessary creativity to resolve the problem. None of the techniques known to us seem to help in producing a satisfactory solution. Frustrated by this impasse we may lean back in our chair, and suddenly remember the joke made by our colleague half an hour ago.

We internally laugh at the joke, and do not realize that thanks to this playful mental intermezzo, our brain is capable of having a sudden insight that will help us to solve the problem. In the case described above the person is basically stumbling from activity to activity, driven by the needs of the brain, without any level of awareness of why this chain of events is occurring. We may even return back home that night believing we had a productive working day, ignorant of the fact that the reason we are irritable is not because our spouse is being unreasonable, but because we are mentally exhausted.

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Figure 1: Ingredients of the Healthy Mind Platter.

Now consider how different things could be. What would happen if we were to start the day after a good night's sleep with half an hour of reflective practice, taking advantage of the rested and centered mind to prioritize the activities of the day? We might consciously plan to take a break over lunch, allowing for down time or even a brief nap, and arrange for a tennis game with a friend right after work, thus combining connecting time and physical activity. When we arrive at work, we mindfully schedule the meetings of the day to alternate individual focus time with meetings with colleagues so as to have a day with variation in brain activity. The result might be that when we come back home we actually have sufficient reserves to connect and play with our children, completing the list of healthy activities for the day before dinner time. Following a healthy mind diet can provide us with the physical and mental well-being necessary to establish and maintain relationships with family, friends and colleagues, and efficiently realize the tasks and responsibilities at school, work, and in our communities.

In the next paragraphs we will provide the scientific foundations for the Healthy Mind Platter, synthesizing what we have learned from clinical work, behavioral research, affective and social neuroscience, and psychology. First we will review the neuro-cognitive benefits of seven key activities: (1) Sleep time; (2) Playtime; (3) Time-in (meditation or reflective practice); (4) Downtime; (5) Connecting time; (6) Physical time; and (7) Focus time. We will explicate their relationships with outcome variables like creativity, health, and cognitive performance. Second, we will present the Healthy Mind Platter (HMP) model, representing the complex relationships between the elements of the HMP as antecedents and moderators for the three variables: creativity, (mental) health and cognitive performance. This approach can serve both as a model with hypotheses for future research and a framework for brain health practice.

Seven neuro-cognitive activities that nurture the mind

1. Sleep time – Refreshing mind and body, and consolidating memory

Sleep is a highly complex and vital process which is essential for the biological balance of the mammalian organism (Benington, 2000), and thought to be critical for homeostatic restoration, thermoregulation, tissue repair, immunity, memory processing, and emotion regulation. Accordingly, sleep deprivation can more lethal than food deprivation.

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According to the 2008 Sleep in America poll on *Sleep, Performance, and the Workplace* conducted by the National Sleep Foundation, Americans said that they wake up, on average, around 5:35 am on workdays and around 7:12 am on non-workdays.

...depression associated with long work hours is primarily a result of sleep deprivation...

Overall, respondents reported an average sleep time of six hours and 40 minutes on workdays, and 44% get less than seven hours of sleep on workdays. About three in ten respondents (29%) reported falling asleep or becoming very sleepy while they were at work in the past month, and just more than one in ten (12%) were late to work in the past month due to sleepiness or a sleep problem. In the U.S., drowsy drivers are responsible for a fifth of all motor vehicle accidents and some 8,000 deaths annually. It is estimated that 80,000 drivers fall asleep at the wheel every day; 10% of those drivers run off the road, and every two minutes, one of them crashes (Fryer, 2006). A study of work hours, sleep, and depression in 2,643 Japanese citizens who were employed full time showed that participants working more than 10 hours per day, sleeping less than six hours per day, and reporting insufficient sleep were, respectively, 37%, 43%, and 97% more likely to be depressed than those working six to eight hours per day, sleeping six to eight hours per day, and reporting sufficient sleep. The study concluded that depression associated with long work hours is primarily a result of sleep deprivation (Nakata, 2011). These statistics do not take into account the vast opportunity costs that sleep deprivation has on the quality and quantity of performance at work.

Since Aristotle and until the middle of last century, sleep was considered a passive state that simply counteracted sleepiness (Payne, 2011). Now, half a century later, there is a general consensus that during sleep we not only rest and recuperate strength for the next day, but sleep is also a highly active state that is important for cognitive processes such as memory consolidation, semantic integration, learning, and the processing of emotions (Stickgold, 2005; Ibañez, San Martin, Dufey, Bacquwr, & Lopez, 2008; Payne, 2011).

Generally a distinction is made between two main types of sleep, rapid eye movement (REM)-sleep and non REM-sleep. REM sleep occurs in roughly 90-minute cycles and alternates with four additional stages (stages 1-4, in order of increasing depth) known collectively as non-REM sleep. Slow wave sleep (SWS) is the deepest of the non-REM phases and is characterized by high-amplitude, low frequency brain oscillations. REM sleep, on the other hand, is a lighter state of sleep characterized by eye movements, decreased muscle tone (which inhibit the acting out of dreams), and low-amplitude, fast brain oscillations. In fact, REM-sleep is a neurophysiological state that is more similar to wakefulness (Hobson & Pace-Schott, 2002) than non-REM states. More than 80% of SWS is concentrated in the first half of the night, whereas the second half of the night contains roughly twice as much REM sleep than the first half (Figure 1).

Sleep and the body:

One proposed theory of sleep, especially slow-wave sleep, involves homeostatic restoration; that is, after a day of 'use', sleep restores chemical and physiological processes that have become depleted during the day. Supporting this idea, the amount and power of slow-wave sleep in the first half of the night is strongly related to the amount of prior sleep and wakefulness, and thereby represents a marker of homeostatic sleep regulation (called 'Process S'). The more hours spent awake, the more sleep pressure one accumulates and the more intense and abundant subsequent slow-wave sleep will be. This 'slow-wave sleep rebound' may reflect a mandatory period of recovery or restoration for multiple biological systems as they recover from the 'wear and tear' of waking activities which is an idea supported by the surge in growth hormone that parallels slow-wave sleep early in the sleep cycle. Growth hormone is not only critical in early development, but also in continued growth and maintenance of bone and tissues throughout life (Payne, 2011).

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Sleep and the mind/brain:

As important as sleep is for the body, evidence suggests that it may be even more critical for the brain. There is strong evidence that sleep's role extends beyond the body and includes critical brain functions, such as memory function, creative processing, and emotion regulation. Recent studies suggest that sleep is critical for solidifying or 'consolidating' memories so that we integrate what we learn into long-term knowledge. Recent studies have shown that during sleep, neuronal populations previously engaged in a learning task are reactivated.

As important as sleep is for the body, evidence suggests that it may be even more critical for the brain.

This reactivation during sleep is a key process for stabilizing memory traces (Diekelmann & Born, 2010). Examples include motor-sequence learning (Walker, Brakefield, Morgan, Hobson, & Stickgold, 2002; Cohen, Pascual-Leone, Press, & Robertson, 2005), visual-discrimination learning (Stickgold, James, & Hobson, 2000), perceptual learning of language (Fenn, Nusbaum, & Margoliash, 2003), and declarative memory (Stickgold, 2005). For instance, learning to navigate a maze during the day is associated with activation in the hippocampus, which is a structure that is essential for normal memory function. During subsequent sleep, there is a reactivation or 'replay' of this hippocampal activation, as if the brain is reprocessing recently learned information. There is a compelling relationship between the increase in hippocampal activation during sleep and the amount of improvement in the maze task the next day. Moreover, if people dream about the maze task, their performance improves still further. This suggests that the re-expression of hippocampal activation during sleep reflects the offline processing of memory traces, which in turn leads to the strengthening of network connections in the brain, resulting in improved memory performance.

REM sleep in particular has been associated with insight and creativity, which is perhaps not surprising given that the most bizarre, fragmented, sometimes emotional and certainly creative dreams happen during REM sleep. A recent report shows that a nap with REM sleep improves people's ability to integrate unassociated information for creative problem-solving (Cai *et al.* 2009). During sleep, our brains integrate information in highly novel ways and make connections that we are simply not capable of seeing during wakefulness (Payne, 2011). In addition, several studies have shown that the suppression of sleep produces deficits in cognitive and emotional processing during wakefulness (Gais & Born, 2004; Durmer & Dinges, 2005; Stickgold & Walker, 2005; Tassi, Bonnefond, Engasser, Hoeft, Eschenlauer, & Muzet, 2006). Even a single night of sleep deprivation can render one more negative and more emotionally unregulated the next day than is experienced with a full night of restorative sleep. Based on this research the expression of "to sleep on it" gains a whole new meaning and the idea that little or no mental activity occurs during sleep is unfounded. Instead, sleep is a highly dynamic and active collection of brain states that are critical for physical, cognitive and emotional health.

But how much sleep should an individual get? It turns out that while the answer is, on average, 8 hours, there is room for individual variation. Sleep need follows a normal distribution or bell curve function with the bulk of individuals requiring seven to nine hours of sleep. However, some individuals require as little as four or as much as 12. While these people are outside the common range of distribution and very rare, they should not be considered to have a disorder.

...even very brief naps can help boost cognitive performance and help us feel more alert.

Understanding one's sleep needs and ensuring these are managed properly is central to a healthy body, brain and mind. What can one do if short on sleep? It turns out even a short nap can help with studies showing that a day's worth of sleep need not be acquired in a single nocturnal chunk. Siesta cultures show us that sleep can be divided into a night of five to seven hours and a daytime nap spanning one to two hours. What seems important is that the so-called 90 minute "ultradian cycles" are preserved. Alternatively, however, even very brief naps can help boost cognitive performance and help us feel more alert. In our "sleep-sick" society, napping has become a regular and sometimes necessary part of our daily lives.

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Research investigating the benefits associated with napping holds potential for informing workplace practices and individual functioning.

If one wants the positive effects of a nap right away, a brief nap is most effective.

In an informative study, Brooks and Lack (2006) assess the benefits of different lengths of naps (5, 10, 20, and 30 minutes). Interestingly, the 10 minute nap conferred the biggest benefit in alertness and performance both immediately after and up to three hours later. The five minute nap was not quite enough to confer a significant benefit while the 20 and 30 minute naps were helpful, but these benefits did not emerge until several hours later, arguably due to the effects of sleep inertia. If one wants the positive effects of a nap right away, a brief nap is most effective. This is because brief naps are more likely to contain light sleep (largely stage 2 NREM sleep), and are short enough to prevent one from delving into slow wave sleep which is restorative but difficult from which to awaken. It is also important to recognize that napping can be learned (with enough practice and diligence); this is key because evidence suggests that regular nappers may glean more benefits from napping than those who only nap out of necessity when absolutely exhausted. Clearly, recent research strongly points to the fact that sleep is far more important than is generally recognized, and though people do not get enough of it, there are easy steps to take to start remedying this problem. Adding a nap to one's day, or an extra 20 minutes to one's sleep cycle (or both) can yield major benefits to cognition, emotional regulation and general performance.

2. Play time – The joy of experimenting with life

> *"Playfulness enhances the capacity to innovate, adapt, and master changing circumstances. It is not just an escape. It can help us integrate and reconcile difficult or contradictory circumstances. And, often, it can show us a way out of our problems."*
>
> Stuart Brown, National Institute for Play

Play, which may seem like a frivolous, unimportant behavior with no apparent purpose, has earned new respect as biologists, neuroscientists, psychologists and others see that play is indeed serious business and is perhaps equally important to other basic drives of sleep, rest, and food (Frost, 1998). Neuroscience research reveals that play-joy is a basic emotional system and essential in child development and adult creativity and learning (Panksepp & Biven, 2012). It has been suggested that play is an important behavioral tendency that does not require learning, is an "experience-expectant" process that has adaptive neurodevelopmental effects which promote later adaptive behaviors and which help program higher brain regions involved in emotional behaviors (Gordon, Burke, Akil, Watson, & Panksepp, 2003).

...the play-joy system is one of the basic emotional systems in human beings similar to rage, fear, expectancy, panic, lust and the maternal nurturance-acceptance system...

According to a report from the American Academy of Pediatrics (AAP), free and unstructured play is healthy and in fact essential for helping children reach important social, emotional, and cognitive developmental milestones as well as helping them manage stress and become resilient. Forces threatening free play and unscheduled time include changes in family structure, the increasingly competitive college admissions process and federal education policies that have led to reduced recess and physical education in many schools. Play is not, however, only vital for children; it also appears to generate cognitive benefits for adults.

Based on his extensive research of play, Panksepp proposes that the play-joy system is one of the basic emotional systems in human beings similar to rage, fear, expectancy, panic, lust and the maternal nurturance-acceptance system (Panksepp, 1991; 1992). Research on rough-housing play in

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mammals, both sapient and otherwise, clearly indicates that the sources of play and laughter in the brain are instinctive and subcortical (Panksepp, 1998). Panksepp's research revealed that if rats are tickled in a playful way, they readily emit 50-kHz chirps (1998; 2003). Given that these chirps are indicative of positive affect and joy, they are probably comparable to human laughter (Panksepp & Burgdorf, 2003; Panksepp, 2005). Although the human capacity for verbal joking probably requires more refined cortically dependent cognitive skills, language probably "tickles" the ancient play circuits of our minds and causes joy to occur (Panksepp, 2005). The rats that were tickled became socially bonded to the experimenters and were rapidly conditioned to seek tickles. The effect of juvenile isolation on these behaviors appears mainly due to deprivation of play (van den Berg, Van Ree, Spruijt, & Kitchen, 1999a). Therefore, play may serve to prepare for more adaptive social behaviors in adulthood. The early games and frivolity of animals and humans equip them for the skills they will need in later life (Angier, 1992; Brown, 1994).

Indeed, human play and laughter is fundamentally a social phenomenon. The reason one cannot tickle oneself may be because the underlying neural systems are controlled by social cues and interactions. These are factors that help weave individuals into the social fabric in which they reside, reflecting different levels of position and dominance (Panksepp & Burgdorf, 2003). Following multiple play bouts, juvenile rats develop dominance hierarchies that remain relatively stable over the juvenile period (Meaney & Stuart, 1981; Panksepp, Siviy, & Normansell, 1984). Preventing male rats from playing has lasting consequences on social (Hol, van de Berg, Van Ree, & Spruijt, 1999; van den Berg, Van Ree, Spruijt, & Kitchen, 1999a; van den Berg, Hol, Van Ree, Spruijt, Everts, & Koolhaas, 1999b), aggressive and sexual behavior (van den Berg, Hol, Van Ree, Spruijt, Everts, & Koolhaas, 1999b). In human children, playing only in isolation has also been associated with social problems (Coplan, Rubin, Fox, Calkins, & Stewart, 1994).

Neuroscientist and play expert Panksepp suggests that one reason for the increasing incidence of attention deficit hyperactivity disorder (ADHD) may be the diminishing availability of opportunities for pre-school children to engage in natural self-generated social play. He suggests that instead of psychostimulants, at-risk children should be stimulated through play in order to facilitate frontal lobe maturation and the healthy development of pro-social minds (2007, see also Panksepp & Biven, 2012). Psychiatrist Stuart Brown, founder of the National Institute for Play, became interested in play when he found that 90% of the 26 murderers he studied had a common history of play deprivation or abnormal play (Brown, 1994; Brown & Vaughan, 2010). This is a sensible conclusion in the light of all the above because play seems to serve an important role in establishing relationships with positive effects. It is a safe way of learning about the "rules of the game" and developing adaptive social behavior. This is of vital importance in children, but is equally important in adults.

...human play and laughter is fundamentally a social phenomenon.

An important benefit of play is that it can facilitate learning. Research in rats has shown that play behavior is considered to be rewarding, as the opportunity to play can be used as an incentive for maze learning (Humphreys & Einon, 1981; Normansell & Panksepp, 1990). Just as in rats, the reward circuits in the brain light up during human mirth (Mobbs, Greicius, Abdel-Azim, Menon, & Reiss, 2003). States of engaged attention between infants and their caregivers tend to be associated with play, states of joy, and general experiences of positive affect (Gottman, Katz, & Hooven, 1997). As play-joy stimulates the reward centers in the brain and is associated with the release of dopamine, which facilitates the establishment and consolidation of new neuronal pathways, which in turn is important for creativity (new connections) and memory (lasting connections). A study by Garaigordobil Landazabal (2005) focusing on the impact of play on the intellectual development of school children aged 10–11 years demonstrated a significant effect of play on verbal intelligence, the ability to form concepts or define words, and on the capacity for verbal associative thinking. The intervention program consisted of a weekly 2-hour play session throughout the academic year.

In their review, Spinka, Newberry and Bekoff (2005) propose that play enables animals to develop flexible emotional responses to unexpected events in which they experience a sudden loss of control. This loss of control has more than a symbolic significance for humans. Indeed, it has been identified as one of the major causes of stress (Karasek & Theorell, 1990; Spector *et al.*, 2002). In the same way that animals play to increase the versatility of movements to recover from sudden shocks such as loss of balance and falling over, young children learn to cope emotionally with unexpected stressful situations by "training for the unexpected." Spinka and his colleagues suggest that the playful switching between in-control and out-of-control elements is cognitively demanding and is accompanied with neuroendocrinological responses that produce a complex emotional state known as "having fun".

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In other words, Mother Nature has provided us with a naturally rewarding activity – play – that allows both animals and humans to experiment with the demands of life itself, practice spontaneous and novel motor and social skills that will prove to be essential for survival in the concrete jungle.

3. Downtime – Disconnecting for integration and insight

When explaining "down time" in workshops we found that this is the most counterintuitive component of the Healthy Mind Platter and needs quite a bit of explaining. "Down time" does not correspond with "leisure time" exactly, which is a much broader term which may refer to hobbies and sports. In the Healthy Mind Platter hobbies are more likely to come under "focus time" and sports under "physical time." With down time we refer to a very specific type of "activity": inactivity, or doing absolutely nothing that has a predefined goal. Think of down time as literally being un-goal-focused. Hanging out, being with one's surroundings, being spontaneous, having no particular goal or focus, as one might do on a lazy Sunday morning with no plans. Down time is more about "being" in the moment with spontaneous emergence of whatever activity may or may not arise rather than "doing" a pre-planned activity with a goal or preset agenda.

...down time is actually intentionally having no intention, of consciously engaging in doing nothing specific...

We have many words in our vocabulary that seem to refer to down time such as idling, hanging around, loafing, lazing, goofing off and chilling out. These terms suggest that down time is not very well understood nor highly regarded. In our definition, down time is actually intentionally having no intention, of consciously engaging in doing nothing specific or "preplanned," a process of disconnecting from intended directions and surrendering to daydreaming, letting our minds wander off in no particular direction with spontaneity and freedom. Downtime may occur between activities: while waiting for an appointment or an airplane, while listening to music or sifting through a magazine, that is, if we do not really pay sustained, focused attention to what is heard or written. If we consciously choose to spend down time, we might find a comfortable chair, in the comfort of our living room or in the shadow of a tree, and disconnect from an intentional, linear focus on our environment. During those periods of down time, we do much more than slumber, rest, and go "offline." During the "inactive" state of wakeful rest or daydreaming, the default neuronal network (or task-negative network) activates. This mode has been found to be characterized by activity in the medial temporal lobe (for memory), the medial prefrontal cortex (for theory of mind and sense of self), the posterior cingulate (related to autobiographical reflection), and the lateral parietal cortex (for integration) (Buckner, Andrews-Hanna & Schacter, 2008).

...unconscious thought produces better decisions than when people decide immediately using conscious, logical reasoning...

Researchers have shown that insight is preceded and aided by disconnecting from deliberate, goal-directed, conscious thinking. In many ways, down time permits a sorting through of many disparate elements of our mental lives, permitting a process called integration – the linkage of differentiated parts – to naturally unfold. The research of Dijksterhuis and his colleagues (2004, 2006) found that unconscious thinkers outperform conscious analysts when making complex decisions. A meta-analysis confirmed that across many studies, unconscious thought produces better decisions than when people decide immediately using conscious, logical reasoning (Strick *et al.*, 2010). Unconscious thought leads to clearer, more integrated representations in memory (Dijksterhuis, Bos, Nordgren, & van Baaren, 2006). What has long been dismissed as reverie and distraction now turns out to be a necessary precursor of insight in complex decision-making. Recent research is showing that not just any "distraction" works, though. Maarten Bos and his colleagues (2011) found that "distraction with a goal" produced better results than "mere distraction." A break in the attentive activity devoted to a

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problem – also referred to as "incubation" – may eventually facilitate the solution process. Research shows that a break from close, focused, effortful attention improves performance with insight problem-solving, and that its length does not make a difference (Segal, 2004).

The very fact that unconscious thought and incubation time is conducive to better decision-making and insight has profound implications for self-leadership.

In their book *The Break-out Principle*, Benson and Proctor (2003) explain that the best way for solving thorny issues or complex problems is first to struggle with it, through problem analysis or fact gathering, up to the point where one stops feeling productive and starts feeling anxious and stressed. This is the signal for the second step: "distracting" oneself from the problem. There are many ways of doing this, including visiting a museum, taking a hot shower, or listening to some calming music. According to the authors, the key is "to stop analyzing, surrender control, and completely detach [oneself] from the stress producing thoughts". This typically leads to what the authors call "the breakout": a sudden insight or a new perspective that sheds a whole new light on the problem at hand.

The very fact that unconscious thought and incubation time is conducive to better decision-making and insight has profound implications for self-leadership. Under pressure of deadlines, quarterly results and shareholders, incubation time is squeezed out of the system, and so is the essential juice of creativity. Caught up in the rat race, laboring under the pressure of demanding objectives, creativity is pushed out of the equation. In this age of the knowledge and service economy, regular breaks on a daily basis, weekends, or on a monthly basis, and sabbaticals on a long-term basis, should not be viewed as a luxury at all. Such breaks are needed to sort and integrate important elements of our minds and permit creativity to emerge. Organizations need "positive turbulence" to build continuous renewal into their cultures (Gryskiewicz, 1999) and develop supportive cultures that foster creative behaviors in employees (Rao, Wilson, & Watkinson, 2009).

Whereas analytical thinking requires an increase and maintenance of (visual) attention, insight is characterized by less focused, inward-directed, more open forms of attention. We propose that down time moderates the relationship between previous knowledge/experience and the generation of new insights. Not just any down time, idle-time, or daydream-time will do. It is important that our brain disconnects and "un-focuses" from the task at hand and its millions of distractions to connect with something entirely different as a condition to have insights on a whole different level. Insight, contrary to analytic thinking, is fast, and manifests as sudden awareness or understanding. Sternberg and Davidson (1995) define insight as a "sudden comprehension that can result in a new interpretation of a situation and that can point to the solution to a problem." In the light of the previous paragraphs this "suddenness" is misleading. It is the result of previously collecting the pieces of the puzzle, and time to let them connect in new and perhaps more integrated ways nonconsciously; new assemblies that are outside of awareness.

...down time moderates the relationship between previous knowledge/ experience and the generation of new insights.

Psychologists have been studying insight for nearly a century, but more recent advances in neuroscience are demonstrating that insight is the culmination of a series of brain states and processes operating at different time scales (Kounios & Jung-Beeman, 2009). Bowden and Jung-Beeman (2003) propose that semantic activation in both hemispheres cooperatively contributes to problem-solving, but weak solution activation that contributes to the "aha-experience" is more likely to occur with neural activations in the right hemisphere than in the left hemisphere.

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The right anterior cingulate cortex is involved in directing attention to detect weakly activated, nonconscious solutions (Kounias & Jung-Beeman, 2009). Kounias *et al.* (2006) suggest that the activity observed in ACC prior to insight may reflect increased readiness to monitor for competing responses, and to apply cognitive control mechanisms as needed to (a) suppress extraneous thoughts, (b) initially select prepotent solution spaces or strategies, and, if these prove ineffective, (c) subsequently shift attention to a non-prepotent solution or strategy. Such shifts are characteristic of insight.

...people are more likely to solve problems with insight if they are in a positive mood.

Understanding the precursors of insight is important, as it may point at interventional opportunities for the facilitation of insight (Kounios & Jung-Beeman, 2009). For instance, Subramaniam, Kounios, Parrish, Jung-Beeman, and Bowden (2009) found that people are more likely to solve problems with insight if they are in a positive mood. Jill Bolte Taylor's fascinating tale "My stroke of insight" (2009) clearly describes how the right hemisphere is "open-minded and thinks out of the box. It's not limited by the rules and regulations established by my left mind that created that box" (2009, p. 148). This right brain is present in the moment, and integrates and nuances thoughts as the left-brain constant chatter is silenced. Segal goes one step further, stating that "the default state has a large emphasis on stimulus-independent thought – mind-wandering, chatter that cannot be cut off – and the deviation from that to a place where people aren't controlled by ongoing internal speech is a place where people are able to find some calm and respite" (2009). Ian McGilchrist (2009) notes that the right hemisphere contributes to a way of being that senses context and the interrelated whole nature of reality whereas the left focuses on text and the individual parts that comprise the world. Downtime may permit integration across the hemispheres and in particular enable the less vocal and assertive right hemisphere's synthetic processing to be sensed and expressed.

The relevance for leadership of understanding the antecedents of insight is great as it is a process that from a neurological point of view is extremely cost effective. It allows connecting very diffuse information in a "moment of genius" where everything becomes suddenly clear with relatively little effort. Such intuition allows experienced managers to make decisions much more quickly which in times of constant change is an enormous advantage. Certain decisions, like buying or selling stock, depend on so many interrelated and complex factors which are in constant flux that using sequential, analytical cognition alone will not suffice. Managers do not always have the opportunity to scrutinize all information, weigh in on all options with conscious deliberation and think through all solutions. Their "bounded rationality" (Simon, 1991) and limited time forces them to trust their more intuitive, sudden insights. Based on what we are learning from the neurosciences, we need to be more cautious in creating the proper conditions for insight. We can intentionally cultivate a positive atmosphere while encouraging the development of mindfulness to stabilize the mind, quiet the internal chatter, and block out external distractions so that what emerges spontaneously can be seen clearly. With intention, we can invite people to respect nonconscious thought and incubation time and enable genius and "thinking outside the box" to bubble up from the wells of experience and relaxation.

We can intentionally cultivate a positive atmosphere while encouraging the development of mindfulness to stabilize the mind...

4. Time-in – Reflection, attunement, mindfulness

Various studies cited by the National Institute for Occupational Safety and Health in the report "Stress at Work" indicate that between 26% and 40% of all workers today feel stressed of burnt out by work (NIOSH, Publication No. 99–101). Roughly 60% of doctor visits stem from stress-related complaints and illnesses (Kroenke & Mangelsdorff, 1989). Confronted with pressure or stress, the brain strives to reestablish and maintain homeostasis through the coordinated activation and control of neuroendocrine and autonomic stress systems. Stress responses are mediated by largely overlapping circuits in the limbic forebrain – the hypothalamus and the brainstem – so that

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the respective contributions of the neuroendocrine and autonomic systems are tuned in accordance with stressor modality and intensity (Ulrich-Lai & Herman, 2009). Sabine Sonnentag and her colleagues have extensively studied the dynamic of recovery experiences and distinguish between psychological detachment from work (i.e. not thinking about job-related issues or problems), relaxation (a process characterized by decreased sympathetic activation), and mastery experiences (challenging off-job experiences that provide opportunities for learning and success) (Sonnentag & Fritz, 2007). Their research showed that low psychological detachment from work during the evening predicted negative activation and fatigue, whereas mastery experiences during the evening predicted positive activation while relaxation predicted serenity. Sleep quality showed positive relations with all affective states. In our Healthy Mind Platter we refer to mastery experiences under "focus time" and to "psychological detachment" under "down time." In this section we focus on reflection, relaxation, and mindfulness.

In his classic work *The Relaxation Response* (1975) Herbert Benson explored the importance and practice of relaxation to a broad business audience. Relaxation is a process characterized by decreased sympathetic activation and becomes evident in a decrease in heart rate and muscle tension (Benson, 1975). There are many relaxation techniques including progressive muscle relaxation (Jacobson, 1938) and various forms of meditation (Grossman, Niemann, Schmidt, & Walach, 2004). Yet, there are also many "everyday activities" that can result in responses similar to relaxation, such as a walk in nature (Hartig, Evans, Jamner, Davis, & Garling, 2003) or listening to music (Pelletier, 2004). There is now a wide body of research showing the beneficial effects of relaxation like the reduction of tension (Van der Klink, Blonk, Schene, & Van Dijk, 2001), and the increase of positive affective states (Stone, Kennedy-Moore, & Neale, 1995; Parkinson & Totterdell, 1999; Fredrickson, 2000).

Yet when we talk about "time-in" in the Healthy Mind Platter we refer to much more than relaxation. Relaxation is actually only one of the aspects or benefits of the broader practice of meditation – a way of training the mind – defined as an intentional self-regulation of attention, in the service of self-inquiry, in the here and now (Masion, Teas, Herbert, Werheimer, & Kabat-Zinn, 1995). There are many forms of meditation. Descriptions of meditation vary and are often expressed in behavioral terms and include (1) relaxation, (2) concentration, (3) altered state of awareness, (4) suspension of logical thought processes, and (5) maintenance of a self-observing attitude (Perez-de-Albeniz & Holmes, 2000). One particular type of meditation that has been scrutinized by neuroscientists in increasing ways recently is mindfulness meditation. Mindfulness has been described as "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 1994). Bishop *et al.* (2004) propose an operational definition distinguishing two components: (1) self-regulation of attention focused on immediate experience and (2) orientation toward one's experiences in the present moment, characterized by curiosity, openness, and acceptance. Rather than changing the environment or the appraisal of the situation, mindfulness aims at becoming aware and accepting thoughts, feelings and bodily sensations. According to Creswell, Way, Eisenberger, and Lieberman (2007) part of the positive effect of mindfulness may be due to labeling affect. Mindfulness in trained individuals has been associated with increased engagement of a right lateralized network, comprising the lateral PFC and viscera-somatic areas such as the insula, secondary somatosensory cortex and inferior parietal lobule (Farb *et al.*, 2007). According to Chiesa and Serretti (2009a), mindfulness meditation activates the prefrontal cortex (PFC) and the anterior cingulate cortex (ACC). Long-term meditation practice is associated with an enhancement of cerebral areas related to attention and emotion regulation (Lazar *et al.*, 2005; Luders, Narr, Thompson, & Toga, 2009). Meta-analytic studies of the impact of mindfulness-based stress reduction seem to suggest that these programs may help a broad range of individuals to cope with their clinical and nonclinical problems, ranging from pain, cancer, heart disease, depression, anxiety, and stress (Grossman, Niemann, Schmidt, & Walach, 2004; Chiesa & Serretti, 2009a; 2009b). A meta-analysis of the effect of mindfulness-based therapy (MBT) on anxiety and depression concluded that MBT improves symptoms of anxiety and depression across a relatively wide range of severity and even when these symptoms are associated with other disorders, such as medical problems (Chiesa & Serretti, 2009b; Hoffman, Sawyer, Witt, & Oh, 2010).

Mindfulness has been described as "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally"

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To conclude, "time-in" is characterized by a very particular type of conscious, focused attention on the inner life of the self in the here and now. Time-in focuses attention on one's intentions and highlights awareness of awareness itself – the two fundamental elements of being mindful (Siegel, 2007). Time-in develops the capacity to be present with experience. Presence, in turn, has been found to be associated with improvements in a number of processes including the levels of the enzyme telomerase, which maintains the telomere caps at the ends of chromosomes within the nucleus of our cells (see Parker, Nelson, Epel, & Siegel, in press). Time-in focuses on acceptance of process rather than content (Perez-de-Albeniz & Holmes, 2000), and can be generally seen to be related to a range of benefits if practiced on a regular basis: in addition to being a wakeful hypometabolic physiological state, it has physiological (e.g. balance of parasympathetic and sympathetic function, health), cognitive (e.g. attention, flexible perspective), emotional (e.g. self-control, stress management), and social (e.g. compassion and empathy) benefits. Regular time-in can therefore be counted among the seven vital activities on the Mental Health Platter.

5. Connecting time – The healing power of relationships

> *"Pleasant words are a honeycomb, sweet to the soul and healing to the bones";*
>
> Solomon, 1000 B.C., Proverbs 16:24

According to Matthew Lieberman, one of the founders of social cognitive neuroscience, our "evolutionary wiring predisposes us to be social," actually causing a sense of physical pain if we are socially rejected (Eisenberger, Lieberman, & Williams, 2003; Eisenberger & Lieberman, 2004). As such one could argue that social connection is a basic human need, very much like water, food and shelter. Social support is a well-documented antecedent of wellbeing. A landmark study of Berkman and Syme (1979) found that the status and extent of social relationships predicts mortality over a 9-year follow-up after controlling for socio-demographic, physical health and health behavior variables. Based on these epidemiological findings, researchers have proposed specific relationships between interpersonal functioning, biological processes, and disease (Pettit, Grover, & Lewinsohn, 2007).

Cohen, Gottlieb and Underwood (2000) propose two processes through which social relationships affect health. One process involves the provision or exchange of emotional, informational, or instrumental resources in response to the perceptions that others are in need of aid. The other process focuses on the health benefits that accrue from participation in one or more distinct social groups. Others can influence cognitions, emotions, behaviors and biological responses in manners beneficial to health and well-being through interactions that are not explicitly intended to exchange help or support, for example to increased self-esteem, personal control, and conformity to behavioral norms that have implications for our health (Cohen, Gottlieb, & Underwood, 2000).

A review of 81 studies revealed that social support is reliably related to beneficial effects on aspects of the cardiovascular, endocrine, and immune systems (Uchino, Holt-Lunstad, Uno, Betancourt, & Garvey, 1999). Social support has been associated with positive effects on various diseases, such as cardiovascular reactivity and blood pressure (Spitzer, Llabre, Ironson, Gellman, & Schneiderman, 1992; Uchino, Holt-Lunstad, Uno, Betancourt, & Garvey, 1999; Gallo, Smith, & Kircher, 2000; Steptoe, 2000; Evans and Steptoe, 2001; Uno, Uchino, & Smith, 2002) and depression (Hays, Steffens, Flint, Bosworth, & George, 2001; Sayal *et al.*, 2002). Reviews of the social support literature (e.g. Berkman, 1984; Cohen & Wills, 1985; House, Landis, & Umberson, 1988) conclude that social integration and perceived emotional support are directly and positively related to physical and mental health, including lower mortality (Thoits, 1995). The most powerful measure of social support is whether a person has an intimate, confiding relationship or not, typically with a spouse or a lover; friends or relatives function similarly but less powerfully (Cohen & Wills, 1985).

...social support is reliably related to beneficial effects on aspects of the cardiovascular, endocrine, and immune systems...

Given that stress is an important cause of sleep problems and cognitive impairment, the buffering effect of social support on stress is pertinent to our discussion of the Healthy Mind Platter. Impaired social functioning may represent a form of stress (Cohen, 2004) that impacts physical health indirectly via emotional experiences (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002) and directly through physiological pathways. Social support is one of the pillars of the job-demand-support model developed by Karasek and Theorell (1990) and adopted by the World Health Organization for predicting stress, cardiovascular disease and productivity. According to a

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meta-analytic review, social support has a threefold effect on work stressor–strain relations (Viswesvaran, Sanchez, & Fisher, 1999): Social support reduces the strains experienced, mitigates perceived stressors, and moderates the stressor–strain relationship.

Lonely individuals may experience higher levels of perceived stress, react more negatively to stress, and benefit less from social interactions...

Cacioppo *et al.* (2000) found that satisfying social relationships are associated with more positive outlooks on life, more secure attachments and interactions with others, more flexible autonomic activation when confronting acute psychological challenges, and more efficient restorative behaviors. Individuals who were chronically lonely had elevated mean salivary cortisol levels across the course of a day, suggesting more discharges of corticotropin-releasing hormone and elevated activation of the hypothalamic-pituitary-adrenocortical axis. Lonely individuals may experience higher levels of perceived stress, react more negatively to stress, and benefit less from social interactions (Cacioppo *et al.*, 2002; Hawkley, Burleson, Berntson, & Cacioppo, 2003). Lonely individuals experience less efficient and less effective sleep that may interfere with the restorative processes of sleep (Cacioppo *et al.*, 2002), another crucial element of the Healthy Mind Platter. In contrast to impaired social functioning, the perception that others are available to provide assistance and emotional support buffers the negative effects of stress on health.

The presence of positive social support reduces the likelihood of negative health outcomes in the wake of stressful events (Rosengren, Orth-Gomer, Wedel, and Wilhelmsen, 1993). In addition, the extent to which individuals actively participate in social activities and hold social roles prospectively predicts health outcomes (Cohen, Doyle, Skoner, Rabin, and Gwaltney, 1997).

Another interesting strand of research studying the interplay between stress, health and social support looks at the impact of neuropeptides like oxytocin. Oxytocin is an evolutionarily highly preserved nonapeptide released from the paraventricular nucleus of the hypothalamus through the posterior pituitary (Buijs, De Vries, Van Leeuwen, & Swaab, 1983). In non-human mammals, oxytocin is a key mediator of complex emotional and social behaviors including attachment, social recognition, and aggression. Oxytocin reduces anxiety and impacts on fear conditioning and extinction (Kirsch *et al.* 2005). Heinrichs, Baumgartner, Kirschbaun, and Ehlert (2003) designed a placebo-controlled, double-blind study, in which 37 men were exposed to the Trier Social Stress Test and were randomly assigned to receive intranasal oxytocin or a placebo as well as social support from their best friend during the preparation period or no such presence of a friend for support. They found that salivary free cortisol levels remained low with social support in response to stress. The combination of oxytocin and social support exhibited the lowest cortisol concentrations as well as increased calmness and decreased anxiety during stress (Heinrich *et al.*, 2003).

...from our earliest days of life our connections to others provide a source of feeling seen, safe, and secure...

Oxytocin administration in humans was shown to increase trust, suggesting involvement of the amygdala, a central component of the neuro-circuitry of fear and social cognition that has been linked to trust (Winston, Strange, O'Doherty, & Dolan, 2002; Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005). In their study Kirsch *et al.* (2005) show that human amygdala function is strongly modulated by oxytocin. They used fMRI to image amygdala activation by fear-inducing visual stimuli after the intranasal application of a placebo or oxytocin. Compared with placebo, oxytocin potently reduced activation of the amygdala and reduced coupling of the amygdala to brainstem regions involved in autonomic and behavioral manifestations of reactive fear (Kirsch *et al.* 2005). Further, from our earliest days of life our connections to others provide a source of feeling seen, safe, and secure

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(Siegel, 2012). Our profoundly social brains may require ongoing connections with close and reliable others in order to maintain the physiologic and emotional balance that such relationships establish from the beginning of life.

To conclude, the link between social support and health is well documented, but the exact neural mechanisms of social cognition in the human brain and the beneficial effects of social supports are complex and need further research drawing from a wide range of disciplines like social cognitive neuroscience, neuro-immuno-endocrinology and occupational health psychology.

6. Physical time – Improving the brain's plasticity through exercise

In an article in the New York Times, Sandra Aamodt and Sam Wang, respectively editor in chief of Nature Neuroscience and associate professor of molecular biology and neuroscience at Princeton take a critical look at computer programs to improve brain performance. The digital brain health and fitness software market is a booming business. According to the 2010 industry report called "Transforming Brain Health with Digital Tools to Assess, Enhance and Treat Cognition across the Lifespan: The State of the Brain Fitness Market 2010" the size of the worldwide market in 2009 was $295 million dollars, a 35% growth since 2008, and representing an annualized growth rate of 31% since 2005. According to Aamodt and Wang (2007):

> *"[a]dvertising for these products often emphasizes the claim that they are designed by scientists or based on scientific research. To be charitable, we might call them inspired by science – not to be confused with actually proven by science. One form of training, however, has been shown to maintain and improve brain health – physical exercise."*

Exercise can help to achieve and maintain brain health and plasticity throughout life (Cotman & Berchtold, 2002). The clinical literature has recognized for years that exercise affects overall health and brain function, especially in later life (Berkman *et al.*, 1993; Blomquist & Danner, 1987; Rogers, Meyer, & Mortel, 1990; Hill *et al.*, 1993; Laurin *et al.*, 2001). Exercise is associated with enhanced metabolism of energy throughout the body (Gomez-Pinilla, 2007).

Studies in humans have demonstrated the beneficial effects of exercise on cognitive function (Suominen-Troyer, Davis, Ismail, & Salvendy, 1986; Kramer *et al.*, 1999). Exercise has the capacity to enhance learning and memory (Suominen-Troyer *et al.*, 1986; Rogers, Meyer, & Mortel, 1990; van Praag, 1999b) under a variety of conditions, ranging from counteracting the mental decline associated with aging (Kramer *et al.*, 1999) to aiding recovery in patients suffering from brain injury or disease (Bohannon, 1993; Lindvall, Kokaia, Bengzon, Elmer, & Kokaia, 1994; Grealy, Johnson, & Rushton, 1999). Cardiovascular fitness training improves overall cognitive function regardless of task type (Colcombe, 2004). Exercise improves "executive functions," the set of abilities (like response speed and working memory) that allows us to select appropriate behavior, inhibit inappropriate behavior, and focus despite distractions (Aamodt & Wang, 2007; Davis, Tomporowski, Boyle, Waller, Miller, & Naglieri, 2007). Moderate aerobic type exercise also reduces stress, decreases anxiety, and alleviates depression (Salmon, 2001). Overall, physical activity has a significant positive and global impact on mental functioning.

Exercise can help to achieve and maintain brain health and plasticity throughout life...

Studies by neuroscientists are strengthening the premise that exercise can benefit brain function and are encouraging additional clinical studies in this area (Cotman & Berchtold, 2002). Research reporting human brain activity during exercise is sparse but consolidates the data in the animal literature, showing that the simple act of moving activates a large percentage of the brain involving sensory/perceptual processes, autonomic regulation, and motor output (Dietrich, 2006). A PET study found that increased brain activation was recorded in the "primary sensory cortex, primary motor cortex, supplementary motor cortex as well as the anterior part of the cerebellum" in response to cycling (Christensen, Johannsen, Sinkjaer, Peterson, Pyndt, & Nielsen, 2000). Another study using single photon emission computed tomography found increases in regional CBF (cerebral blood flow) in the supplementary motor area, medial primary sensorimotor area, striatum, visual cortex, and cerebellar vermis during walking (Fukuyama *et al.*, 1997).

...physical activity has a significant positive and global impact on mental functioning.

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Exercise is an activity that, if practiced on a regular basis, activates molecular and cellular cascades that support and maintain brain plasticity. It induces the expression of genes associated with plasticity and promotes brain vascularization, neurogenesis, functional changes in neuronal structure and neuronal resistance to injury (Cotman & Berchtold, 2002). Exercise activates mechanisms that protect the brain from damage. Studies in animals show that physical activity, in the form of voluntary wheel running, can increase levels of brain-derived neurotrophic factor (BDNF), a molecule that enhances synaptic growth, increases neuronal survival, promotes learning and protects against cognitive decline. It also increases other growth factors, stimulates neurogenesis, increases resistance to brain insult and improves learning and mental performance and induces gene expression changes in the brain (Cotman & Engesser-Cesar, 2002; Cotman & Berchtold, 2002). The finding that exercise increases BDNF levels in the hippocampus – an area vital for memory formation and learning – has provided insight about the possible molecular mechanisms responsible for the positive effects of exercise on cognition (Neeper, Gomez-Pinilla, Choi, & Cotman, 1995; Gomez-Pinilla, Ying, Roy, Molteni, & Edgerton, 2002; Vaynman, Ying, & Gomez-Pinilla, 2004). By inducing BDNF and other molecules, exercise strengthens neuronal growth and interconnected synaptic linkages among neurons and facilitates synaptic transmission, thus priming activated cells for encoding into long-term storage (Cotman & Berchtold, 2002).

7. Focus time – Attention management for performance

Today's business context is characterized by a number of tendencies that combined have radically increased the fragmentation of time. Developments in communication and information technology have multiplied and made more immediate and intricate the nature of our connectivity. Globalization has intensified competition and with it customers increasingly expect 24/7 access, just-in-time deliveries, and minimum waiting times. In turn, firms expect their managers to be flexible, mobile, and available to meet customer expectations. With a steady increase of women in the labor force, dual earner families have become the norm, and juggling work and family responsibilities are now a concern for both men and women. In this context time is being fragmented and focus scattered. There is less time available for more tasks and responsibilities. Since time is a scarce resource, those skilled in (re-)focusing quickly and staying focused within fragments of time will thrive and be more successful. This requires the capacity to manage one's attention: to focus entirely on the person or task at hand while also exerting self-control to block out interferences.

The central component of the Healthy Mind Platter for those concerned not just with brain health but also performance is undoubtedly focus time: the time we are able to focus, stay focused and refocus efficiently and effectively. Focusing attention involves several functions, including alerting, orienting, and executive control (Tang & Posner, 2009). The executive capacity to focus is dependent on a well-developed prefrontal cortex (PFC), also referred to as the executive part of the brain, responsible for most of the higher cognitive functions organizing actions, both physical and mental. The PFC's functions are wide and varied; they include capacities such as: (1) working memory, involved in organizing and structuring information, remembering self and creating images of the possible future, for consequence evaluation, and long-term planning; and (2) processes for monitoring behavior and inhibiting pre potent responses, including emotion regulation and self-observation (Siegel, 2010). Our executive functions allow us to reconsider the environment moment to moment and make choices that may be different to our automatic responses.

Developments in communication and information technology have multiplied and made more immediate and intricate the nature of our connectivity.

When we focus we activate working memory long enough to allow other recombinant processes to happen within this "chalkboard of the mind." This consists of encoding the information through the activity of the hippocampus and parts of the cortex to create linkages among aspects of experience that encode both context and the explicit elements of factual and autobiographical memory. Ultimately, these forms of explicit memory can be flexibly retrieved enabling us to have a context for the present, an understanding of the past, and to more effectively plan for the future as we harness the power of the prefrontal cortex.

To focus is to pay close attention. Attention is a complex process involving multiple parts of the brain related to perception, arousal, emotion, and memory. The attention process, akin to putting "a spotlight" on something, consists

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of three stages which involve different parts of the brain, and different systems (norepinephrine and dopamine) (Carter, 1998, p. 305): (1) Alerting (Reticular Activating System, brainstem, thalamus), activated by fear or novelty; (2) Orienting (thalamus, superior colliculus, parietal cortex), to orient or direct the focus of processing on input from the sensory organs or internally generated neural activity from the cortex; and (3) Executive functions (PFC, ACC, striatum) that can hold information in mind and make choices about processes as they occur.

A lack of stimulation (boredom) and overstimulation (stress) leads to impairment of executive functions, distraction, and lack of focus.

These higher cognitive functions mediated by the PFC have been found to require adequate levels of catecholamines, which in turn are altered by levels of arousal or stress. A lack of stimulation (boredom) and overstimulation (stress) leads to impairment of executive functions, distraction, and lack of focus. In these conditions, the brain can be altered to enter a state of hypo- or hyper-vigilance that can impair performance. Attention can therefore be considered to be dependent on a state of optimal arousal that activates our body and mind to process the incoming information and respond adequately. In order for a person to function at optimal levels of arousal, predictability and a sense of control are necessary. Deep breathing, mindfulness (openness and acceptance to what arises in the field of attention), and framing the stressor as controllable or transient can also help to maintain or bring a person back to optimal levels of arousal and attentional focus. In short, there is a direct relationship between stress, focus, and health. One could even propose that the capacity to focus attention is an ongoing indicator of mental fitness. Many mental difficulties such as Attention Deficit Hyperactivity Disorder (ADHD), schizophrenia, and Alzheimer's disease are characterized by attention problems.

Another aspect of focus time is sustaining attention, or staying focused, which is a function of self-control. This important function of motoric, cognitive, and emotional control is mediated by activity in the (ventrolateral) prefrontal cortex (areas 44, 45, and 47). Lesions or dysfunction in this area are associated with obsessive-compulsive behavior and addictions. The exertion of self-control appears to depend on a limited resource. Just as a muscle gets tired from exertion, acts of self-control cause short-term impairments (mental depletion) in subsequent self-control, even on unrelated tasks. Research has supported this strength framework for understanding the possible challenges in the domains of eating, drinking, spending, sexuality, intelligent thought, making choices and interpersonal behavior (Baumeister, Vohs & Tice, 2007). These authors note that motivational or framing factors can temporarily block the deleterious effects of being in a state of mental depletion, and that blood glucose is a component of the energy required for effective executive control.

Last but not least there is the capacity to re-focus following distraction or during multi-tasking. Given the limited capacity of our working memory, rather than processing multiple sources of information simultaneously, we continuously switch our spotlight of attention back and forth between different stimuli. As a consequence we divide attention, and allocate less time to each task, or distribute a given focus in divided ways over a longer time span. The logical consequence is that multi-tasking impairs performance, also referred to as "dual task interference." According to Meyer *et al.*, multitasking requires multiple cognitive micro-processes (1998), involving multiple regions of the brain (1997), including the dorsolateral PFC for goal-shifting and refocusing attention, the posterior parietal lobe for activating the task's procedural rules, the ACG for error monitoring, and the pre-motor cortex for anticipatory movement preparation. The time required for executing all these micro-processes depends on a series of criteria, but in general increases with the number of interruptions, switching from one task to the other (Rubinstein, Evans, & Meyer, 1994).

In the Healthy Mind Platter, focus time involves the application of a singular attentional focus on a task that permits a sense of mastery and completion. Focus time enables an individual to avoid the sense of being overwhelmed and incomplete that so often accompanies multitasking. Focus time is both a cognitive process necessary for effective performance, and an intentional effort that requires self-control, both of which require energy and the management of stress. This has important implications for self-management – keeping down the "switching-time costs" of multitasking which diminishes cognitive performance. In these ways, focus time is helpful for the process of a sense of efficacy in the outcome of efforts and the effective sense of contributing to work output.

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Discussion and Conclusion

In this article we introduced the Healthy Mind Platter, a framework for managing our lives and promoting mental, relational, and brain health. This approach may be useful in informing schools, organizations, governments, and communities about the necessary "mental nutrients" that entail the daily mental activities that promote well-being. The ingredients of the Healthy Mind Platter are Sleep time, Play time, Time-in, Downtime, Connecting time, Physical time, and Focus time. The Healthy Mind Platter can be used as a simple visual framework to promote and increase the awareness of mental health in our daily lives. Following a healthy mind "diet" can provide us with the physical and mental wellbeing necessary to establish and maintain relationships with family, friends and colleagues and efficiently realize the tasks and responsibilities at school, work and in our communities. The mind can be seen to emerge from both body and relationships, and so the Healthy Mind Platter focuses on our bodies, our social connections and how we focus our minds themselves (See Siegel, 2012a and 2012b).

Following a healthy mind "diet" can provide us with the physical and mental wellbeing necessary to establish and maintain relationships...

Although we have introduced the different factors constituting the Healthy Mind Platter individually, there are many direct and indirect and sometimes complex interrelations between them. All ingredients have clear and well-documented relationships with one or several of the outcome variables, creativity, mental health and cognitive performance. Downtime, play time, connecting time, time-in and focus time are associated with creativity. All factors are related with mental health.

Focus time has complex relationships with many other variables. First, focus time is a logical antecedent of cognitive performance. Focusing involves a coordinated constellation of cognitive processes necessary for thinking or acting consciously and intelligently in general. If focus time is characterized by "flow" or engagement; according to positive psychologists like Seligman (2011) and Csikszentmihalyi (1990), it has many beneficial effects for health. For instance, active leisure time is an example of focus time which allows us to completely distract ourselves from work and reconnect with a refreshed mind. The relationship between focus time and cognitive performance is moderated by sleep time, down time, and time-in. Without sufficient rest and breaks, people may be quite challenged to maintain focus. Without alternating focus time with instances of reflection within time-in, for example, attention fades and the level of processing may be restricted to only surface considerations.

Moments before an insight, we unfocus visually and mentally to enable an idea to bubble to the surface.

The relationship between focus time and creativity is a complex one. As mentioned in the section on down time, insight often does not occur without previous processes of analysis (focus time) and incubation (down time, sleep time, time-in), for the pieces to come together in a creative "Aha" way, or within a complex decision-making process. Moments before an insight, we unfocus visually and mentally to enable an idea to bubble to the surface. Interestingly, EEG assessments of gamma-waves suggest this cognitive event resembles moments of deep meditation. In other words, in some cases, different ingredients in the Healthy Mind Platter (e.g. focus time, down time, time-in) alternate with each other instantaneously to produce yet another phenomenon (e.g. a transient state of insight or creativity).

A second complex relationship is between physical time and cognitive performance, which we discussed in the section on physical time. According to the transient hypofrontality hypothesis, during exercise and exertion of effort, cognitive

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performance decreases because blood is disproportionally concentrated in the muscles. Following exercise and long afterwards, however, physical activity practice should increase cognitive performance thanks to improved blood distribution to the brain and due to enhanced neuroplasticity following exercise. In addition, down time and sleep time moderate the relationships between physical time and mental health. Both incessant physical activity without rest and a general lack of exercise can endanger (mental) health. While we have not listed amounts of time or ratios of proportions of time to be spent in engaging in these activities, each individual and each program harnessing the Healthy Mind Platter can apply reflective reasoning to including each of these activities on a daily basis within a range of time allotted for each that may depend on the day and on the individual. Sleep time, for example, may vary depending on age, but for the average adult, seven to eight hours are the typical amount often needed. For children and adolescents, this time is often greater – though modern life makes teenagers challenged to achieve the eight to nine hours of sleep that may be needed for optimal functioning and well-being, ideally such important healthy priorities should be achieved if possible.

Further research is needed to understand which combinations are needed, and in what order, proportion and relationship, to produce optimal levels of creativity, health, and performance. We can conclude from our review that as we are writing, neuroscientists, psychologists, molecular biologists, and many other researchers around the world are independently investigating the physical and mental substrates underlying the relationships between the elements of the Healthy Mind Platter and a variety of health outcomes. A range of disciplines may contribute meaningfully to research that will be required to study which different constellations among these elements represent the best recipes for public health and individual and organizational performance. As for the field of neuroleadership, the Healthy Mind Platter offers a theoretical model to study and optimize the mental well-being, brain health, creativity and performance of leaders. For families, schools and our wider society, the Healthy Mind Platter offers a framework to open the conversation and facilitate the work of public health policy makers, health practitioners, educators, coaches, organizational consultants, and many other professionals to develop and evaluate interventions. As the brain takes more of a central stage in health management, science, and society at large, we need to integrate insights generated in laboratories around the globe to confront one of the biggest scientific, public health, and economic challenges of the 21st century: improving brain health and plasticity to deal with the increasing complexity and uncertainty unfolding around us.

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