T. Kayes Open Forum BOS 12/11/18

El Dorado County Board of Supervisors
Meeting Date: December 11, 2018
Open Forum Commentary
By Terry Kayes, District 3

Connecting the Dots: the Camp Fire, Thinking, Reading, Memory, Precise Language, and Effective Government

Later, I will explain the multiple causes of the Camp Fire in Butte County, which began on November 8, 2018, will tell the history of events over the past six decades that lead up to that catastrophic fire, and will explain how, by careful planning and years of effort, the City of Chico with some of its people managed to avoid being set ablaze by that fire, as was the Town of Paradise and the 200-plus square miles around it of mixed timberland and chaparral.

There's much to be learned from telling that story, but first, as a primer, I feel the need to make a few comments about effective government, based on fact-based thinking rather than myths.

Over the past months, I have made the declarative statement at least three times that effective government cannot be achieved by "operating out of a grab bag of preconceived notions." By the latter, I mean the demonstrably false conceptions that come out of too-many school books, the mass media, and the marketing hype produced by those corporate, educational and government entities intent on convincing the many "magic-thinkers" among us that panaceas exist and can be found through the application of yet more digital technologies. The insidious "joker in the deck" regarding screen-linked technologies is, tragically, that many of them have for many years been known to be addictive and have seriously adverse effects on cognition, attention span, the act of reading, the connection between working and long-term memory, reading comprehension and recalling later what's been read, and on fully understanding the precise meanings of words.

To believe that effective government can be achieved to avoid such catastrophes as the Camp Fire, in the face of such harsh realities as decades of "dumbing down" and "digital dementia" seems to me to be questionable without first pointing out that one of the big reasons why effective government has become so difficult in recent times has been the documented decline in effective thinking over the past 50 years, and particularly over the past 20 with the rise of the Internet. This is a fact.

To help you better appreciate and I hope deal with this decline in effective thinking, I am providing you with printed copies of the following online articles, which, if you decide to read them, may give you a better "lead in" to what I hope to explain later about the Camp Fire, air pollution and related matters — all of which are parts of a complex set of knotty difficulties that can only be effectively addressed by dealing with them as a whole.

As for the articles I am distributing today, their titles are:

> "Gray Matters: Too Much Screen Time Damages the Brain"

> "Screens and the Stress Response"

> "Effects of Stress on Memory"

> "The Unexpected Effects of All That Screen Time"

> "Digital dementia: What We and Our Children are Doing to our Minds." by Manfred Spitzer (a book review)

> "The Reading Brain in the Digital Age: The Science of Paper versus Screens"

Whether or not, and how people read, in today's world, in my experience, quite often determines how effectively they think, especially about matters pertaining to government.

Thank you for your attention.

https://www.psychologytoday.com/us/blog/mental-wealth/201402/gray-matters-too-much-screen-time-damages-the-brain

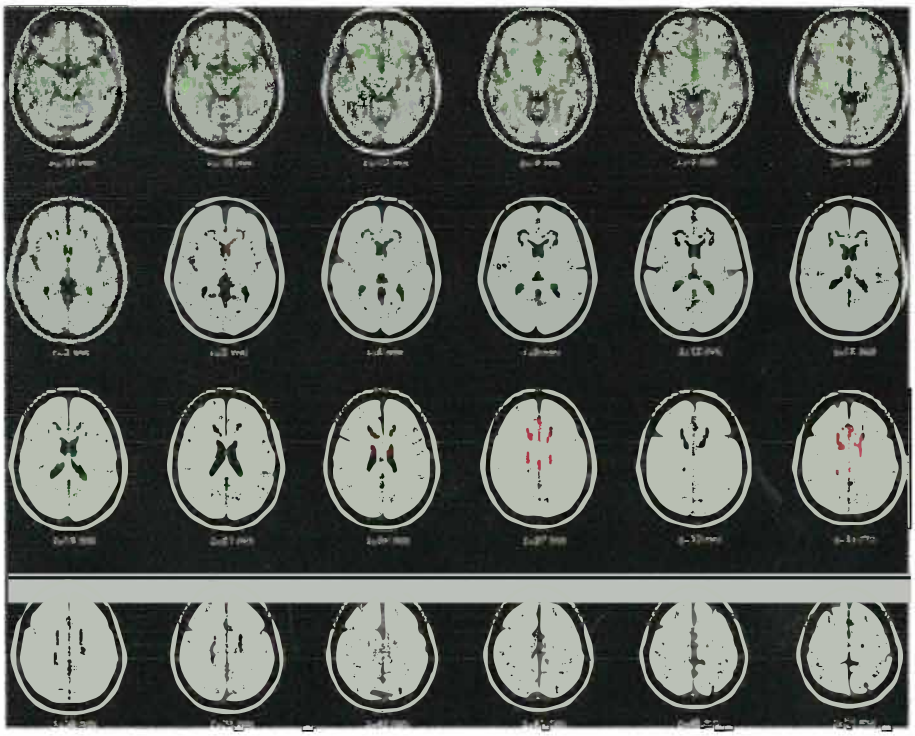
Psychology Today

Gray Matters: Too Much Screen Time Damages the Brain

Neuroimaging research shows excessive screen time damages the brain.

By Victoria L. Dunckley M.D.*

February 27, 2014



Source: Lin, Zhou,Lei, et al., used with permission. Red areas designate abnormal white matter in internet addicted teens.

"Taken together, [studies show] internet addiction is associated with structural and functional changes in brain regions involving emotional processing, executive attention, decision making, and cognitive control." —research authors summarizing neuro-imaging findings in internet and gaming addiction (Lin & Zhou et al, 2012).

But what about kids who aren't "addicted" per se? Addiction aside, a much broader concern that begs awareness is the risk that screen time is creating subtle damage even in children with "regular" exposure, considering that the average child clocks in more than seven hours a day (Rideout 2010). As a practitioner, I observe that many of the children I see suffer from sensory overload, lack of restorative sleep, and a hyperaroused nervous system, regardless of diagnosis—what I call electronic screen syndrome. These children are impulsive, moody, and can't pay attention—much like the description in the quote above describing damage seen in scans.

Although many parents have a nagging sense that they should do more to limit screen-time, they often question whether there is enough evidence to justify yanking coveted devices, claiming that it's "part of our kids' culture," or worry that others—such as a spouse—will undermine their efforts. Digest the information below, even though it might feel uncomfortable, and arm yourself with the truth about the potential damage screen time is capable of imparting—particularly in a young, still-developing brain. (But also in adult brains, based on decades of research by cognitive scientists— inserted comment by T. Kayes.)

Brain scan research findings on screen addiction:

Gray matter atrophy: Multiple studies have shown atrophy (shrinkage or loss of tissue volume) in gray matter areas (where "processing" occurs) in internet/gaming addiction (Zhou 2011, Yuan 2011, Weng 2013, and Weng 2012). Areas affected included the frontal lobes,

which govern executive functions, such as planning, prioritizing, organizing, and impulse control ("getting stuff done"). Volume loss was also seen in the striatum, which is involved in reward pathways and the suppression of socially unacceptable impulses. A finding of particular concern was damage to an area known as the insula, which is involved in our capacity to develop empathy and compassion for others and our ability to integrate physical signals with emotion. Aside from the obvious link to violent behavior, these skills dictate both the depth and quality of personal relationships.

Compromised white matter integrity: Research has also demonstrated loss of integrity in the brain's white matter (Lin 2012, Hong 2013, Weng 2013). "Spotty" white matter translates into an overt loss of communication within the brain, including connections to and from various lobes of the same hemisphere, links between the right and the left hemispheres, as well as pathways between the higher (cognitive) and lower (emotional and survival) brain centers. White matter also connects neural networks from the brain to the body, and vice versa. Interrupted connections may slow signals, "short-circuit" them—or cause them to be erratic ("misfire").

Reduced cortical thickness: Hong et al. found diminished cortical (the outermost part of the brain) thickness in internet-addicted teen boys (Hong 2013), and Yuan et al. found reduced cortical thickness in the frontal lobe of Internet gaming addicts (late adolescent males and females) were linked to impairment of a cognitive task (Yuan 2013).

Impaired cognitive functioning: Imaging studies have found less efficient information processing and reduced impulse inhibition (Dong & Devito 2013), increased sensitivity to rewards and insensitivity to loss (Dong & Devito 2013), and abnormal spontaneous brain activity associated with poor task performance (Yuan 2011).

Cravings and impaired dopamine function: Research on the effects of video games have shown dopamine (implicated in reward processing and addiction) is released during gaming (Koepp 1998 and Kuhn 2011) and that craving or urges for gaming produces brain changes that are similar to drug cravings (Ko 2009, Han 2011). Other research findings on internet addiction include reduced numbers of dopamine receptors and transporters (Kim 2011 and Hou 2012).

In short, excessive screen-time appears to injure brain structure and function. Much of the injury occurs in the brain's frontal lobes, which undergo massive changes from early puberty until the mid-twenties. Frontal-lobe development, in turn, largely determines success in every area of life—from sense of well-being to academic or career success to relationship skills. Use this research to strengthen your own parental position on screen management and convince others to do the same.

(All the above effects apply as much to adults as they do to teenagers. Also, these adverse effects apply as much to online social networking and other "unfettered" uses of "screen-connected" digital devices and technologies—inserted comment by T. Kayes.)

For more help in managing screen-time, visit the following website: www.drdunckley.com/videogames/.

For more information on how the physiological effects of electronics translate into symptoms and dysfunctions—as well as how to reverse such changes—see my 2015 book, Reset Your Child's Brain.

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Victoria L. Dunckley, M.D., the author of the 2015 book *Reset Your Child's Brain*, is an award-winning integrative child psychiatrist who specializes in children with complex or treatment-resistant mental health conditions. By combining conventional and complementary methods with lifestyle interventions, she aims to optimize treatment while minimizing the need for psychotropic medications. She consults with schools, multi-disciplinary treatment teams, and the courts, and has a special focus on the physiological impact of screen-time on the developing nervous system. She is

a speaker for parents' groups and in mental health training, and divides her practice between private and public sectors in Los Angeles County.

After receiving a biology degree at the University of California San Diego, Dr. Dunckley pursued her medical training at Albany Medical College in New York, returning to the West Coast for her psychiatric residency and child/adolescent fellowship at U.C. Irvine's Neuropsychiatric Center. She's since worked in a variety of community mental health settings, including residential treatment centers and clinics catering to adoptive, foster and transitional-age youths, and Regional Centers helping clients with neuro-developmental disabilities.

In her private practice she has extensive experience treating tics/Tourette Syndrome, ADHD, bipolar disorder, attachment disorder, and PTSD (post-traumatic stress disorder). Whether in the private or public setting, she is known for going the extra mile to help each and every patient achieve his or her maximum potential.

A diplomate of the American Board of Psychiatry and Neurology, the American Academy of Child and Adolescent Psychiatry, and the American Board of Integrative Holistic Medicine, Dr. Dunckley has also been named one of *America's Top Psychiatrists* by the Consumer's Research Council of America and won *Patient's Choice* and *Compassionate Doctor* awards by Vitals.com.

https://www.psychologytoday.com/us/blog/mental-wealth/201211/screens-and-the-stress-response

Psychology Today

Screens and the Stress Response

A growing body of evidence links electronic screen media to stress markers.

By Victoria L. Dunckley M.D.*

November 17, 2012

Screens are a form of environmental stress (Photographies/Fotolia).

I just returned from an inspirational week-long conference on the science and application of integrative medicine. Highly informative, the theme heard again and again was that mitigating stress through a combined approach of mind-body work, proper sleep, exercise, reducing toxin load, and eating a nutritious diet was highly effective

in combating illness — and had a much greater impact on prognosis than traditional western medical treatments — whether that "illness" be mental or physical.

What I *didn't* hear much of (or at least not enough of) was the impact of screen time on stress and illness severity, particularly in regards to mental disorders, which are highly sensitive to stressors of any kind. A primary goal of the integrative-medicine approach is to take the body out of fight-or-flight mode and into healing mode as much as possible. How can we ignore the impact of screens, which assault us daily? Screen time has a lot of negative health effects. This post will focus on studies that link screen time to physiological stress markers.

Study Findings on Electronic Screen Media Associated With Physiological Stress Markers

1. Computer game playing assessed as valid psychological stressor to induce physiological effects of stress, including changes in autonomic tone (heart rate and blood pressure), EMG (muscular activity), Galvanic Skin Response (skin conductivity), and cortisol levels (Sharma et al., 2006).

2. Computerized games can impair blood sugar control and delay digestion (Blair et al., 1991).

3. Attention can be impaired via the stress hormones norepinephrine and cortisol following psychological stress (video game used as a test stressor) (Skosnik et al., 2000).

4. Screen time is associated with narrowed vasculature of the retina (narrowed blood vessels at back of the eyes, a cardiovascular risk) in children, while time spent outside is associated with healthy retinal vasculature (Gopinpath et al., 2011).

5. Screen time is associated with metabolic syndrome (high blood pressure, blood sugar dysregulation, high lipids, obesity) in adolescents *independent* of physical inactivity (Kang et al., 2010).

6. Video game playing is associated with increased food intake in adolescents (Chaput et al., 2011).

7. Exposure to EMFs (electromagnetic fields) from cell towers is associated with perceptual speed increase and accuracy decrease (consistent with a fight-or-flight response), as well as significant sleep problems (Hutter et al., 2006).

8. Cell phone use and texting is associated with faster, but less accurate, cognitive responses in teens (Abramson et al., 2009).

Hopefully, these studies provide some food for thought. Advising parents to severely limit screen time is often met with significant resistance, and part of that resistance, I believe, is due to an underappreciation of screen time's potent effects on the stress response. Looking at evidence clearly linking screens to stress markers can help fill that gap and push us all to remember that strict limitation of screen time should be an essential component of an integrative approach to mental wellness.

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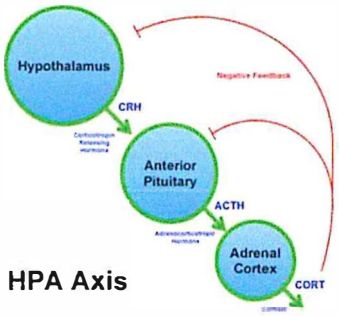
Effects of stress on memory

The **effects of stress on memory** include interference with a person's capacity to encode memory and the ability to retrieve information.[1][2] During times of stress, the body reacts by secreting stress hormones into the bloodstream. Stress can cause acute and chronic changes in certain brain areas which can cause long-term damage.[3] Over-secretion of stress hormones most frequently impairs long-term delayed recall memory, but can enhance short-term, immediate recall memory. This enhancement is particularly relative in emotional memory. In particular, the hippocampus, prefrontal cortex and the amygdala are affected.[4][5] One class of stress hormone responsible for negatively affecting long-term, delayed recall memory is the glucocorticoids (GCs), the most notable of which is cortisol.[1][5][6] Glucocorticoids facilitate and impair the actions of stress in the brain memory process.[7] Cortisol is a known biomarker for stress.[8] Under normal circumstances, the hippocampus regulates the production of cortisol through negative feedback because it has many receptors that are sensitive to these stress hormones. However, an excess of cortisol can impair the ability of the hippocampus to both encode and recall memories.[2] These stress hormones are also hindering the hippocampus from receiving enough energy by diverting glucose levels to surrounding muscles.[2]



a diagram of the hypothalamic–pituitary–adrenal axis

Stress affects many memory functions and cognitive functioning of the brain.[9] There are different levels of stress and the high levels can be intrinsic or extrinsic. Intrinsic stress level is triggered by a cognitive challenge whereas extrinsic can be triggered by a condition not related to a cognitive task.[7] Intrinsic stress can be acutely and chronically experienced by a person.[7] The varying effects of stress on performance or stress hormones are often compared to or known as "inverted-u"[9] which induce areas in learning, memory and plasticity.[7] Chronic stress can affect the brain structure and cognition.

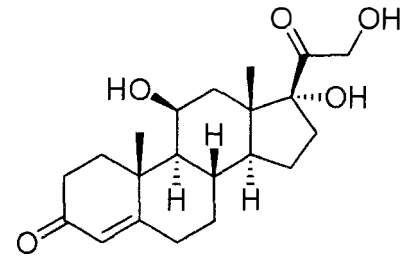
Studies considered the effects of stress on both intrinsic and extrinsic memory functions, using for both of them Pavlovian conditioning and spatial learning.[7] In regard to intrinsic memory functions, the study evaluated how stress affected memory functions that was triggered by a learning challenge. In regard to extrinsic stress, the study focused on stress that was not related to cognitive task but was elicited by other situations. The results determined that intrinsic stress was facilitated by memory consolidation process and extrinsic stress was determined to be heterogeneous in regard to memory consolidation. Researchers found that high stress conditions were a good representative of the effect that extrinsic stress can cause on memory functioning.[7] It was also proven that extrinsic stress does affect spatial learning whereas acute extrinsic stress does not.[7]

Contents

Physiology

When a stressful situation is encountered, stress hormones are released into the blood stream. Adrenaline is released by the adrenal glands to begin the response in the body. Adrenaline acts as a catalyst for the fight-or-flight response,[10] which is a response of the sympathetic nervous system to encourage the body to react to the apparent stressor. This response causes an increase in heart-rate, blood pressure, and accelerated breathing. The kidneys release glucose, providing energy to combat or flee the stressor.[11] Blood is redirected to the brain and major muscle groups, diverted away from energy consuming bodily functions unrelated to survival at the present time.[10] There are three important axes, the adrenocorticotropic axis, the vasopressin axis and the thyroxine axis, which are responsible for the physiologic response to stress.

Adrenocorticotropic hormone axis



Cortisol

When a receptor within the body senses a stressor, a signal is sent to the anterior hypothalamus. At the reception of the signal, corticotrophin-releasing factor (CRF) acts on the anterior pituitary. The anterior pituitary in turn releases adrenocorticotropic hormone (ACTH).[12][13] ACTH induces the release of corticosteriods and aldosterone from the adrenal gland. These substances are the main factors responsible for the stress response in humans. Cortisol for example stimulates the mobilization of free fatty acids and proteins and the breakdown of amino acids, and increases serum glucose level and blood pressure,[11] among other effects.[14] On the other hand, aldosterone is responsible for water retention associated with stress. As a result of cells retaining sodium and eliminating potassium, water is retained and blood pressure is increased by increasing the blood volume.

Vasopressin axis

A second physiological response in relation to stress occurs via the vasopressin axis. Vasopressin, also known as antidiuretic hormone (ADH), is synthesized[*where, when and how?*] and regulates fluid loss by manipulating the urinary tract.[15] This pathway allows water reabsorption within the body and decreases the amount of water lost through perspiration. ADH has the greatest[*greatest among what?*] effect on blood pressure within the body. Under normal circumstances, ADH will regulate the blood pressure and increase or decrease the blood volume when needed.[11] However, when stress becomes chronic,

homeostatic regulation of blood pressure is lost. Vasopressin is released and causes a static increase in blood pressure. This increase in blood pressure under stressful conditions ensures that muscles receive the oxygen that they need to be active and respond accordingly.[15] If these stressful conditions remain elevated, muscles will become fatigued, resulting in hypertension and in extreme cases can result in death.

Thyroxine axis

The third physiological response results in the release of thyrotropic hormone-release factor (TRF)[*Where, when and how?*] which results in the release of thyrotropic hormone (TTH).[16] TTH stimulates the release of thyroxine and triiodothyronine from the thyroid.[16] This results in an increased basal metabolic rate (BMR).[*What effect does that have?*] This effect is not as immediate as the other two, and can take days to weeks to become prevalent.

Chronic stress

Chronic stress is a stressor that is ongoing for a long period of time. When chronic stress is experienced, our body is in a state of continuous physiological arousal.[17] Normally, our body activates our fight-or-flight-response, and when the perceived stress is over our body returns to a state of homeostasis. When chronic stress is perceived, however, the body is in a continuous state of fight-or-flight response and never reaches a state of homeostasis. The physiological effects of chronic stress can negatively affect memory and learning.[17] One study used rats to show the effects of chronic stress on memory by exposing them to a cat for five weeks and being randomly assigned to a different group each day.[18] Their stress was measured in a naturalistic setting by observing their open field behaviour, and the effect on memory was estimated using the radial arm water maze (RAWM). In the RAWM, rats are taught the place of a platform that is placed below the surface of the water. They must recall this later to discover the platform to exit the water. It was found that the rats exposed to chronic psychosocial stress could not learn to adapt to new situations and environments, and had impaired memory on the RAWM.[18]

Chronic stress affects a person's cognitive functioning differently for normal subjects versus subjects with mild cognitive impairment. Chronic stress and elevated cortisol (a biomarker for stress) has been known to lead to dementia in elderly people.[3] A longitudinal study was performed which included 61 cognitively normal people and 41 people who suffered from mild cognitive impairment. The participants were between 65 and 97 years old. 52 of the participants were followed for three years and repeatedly received stress and cognitive test assessments. Any patient that suffered from signs or conditions that would affect their cortisol level or cognitive functioning was exempt from participating.[8]

In general, higher event based stress was associated with more rapid cognitive impairment. However, participants with greater cortisol levels showed signs of slower decline. Neither of these effects held for the non-cognitively-impaired group.[8]

Acute stress

Acute stress is a stressor that is an immediate perceived threat.[19] Unlike chronic stress, acute stress is not ongoing and the physiological arousal associated with acute stress is not nearly as demanding. There are mixed findings on the effects of acute stress on memory. One view is that acute stress can impair memory, while others believe that acute stress can actually enhance memory. Several studies have shown that stress and glucocorticoids enhance memory formation while they impair memory retrieval.[20] For acute stress to enhance memory certain circumstances must be met. First, the context in which the stress is being perceived must match the context of the information or material being encoded.[21] Second, the brain regions involved in the retrieval of the memory must match the regions targeted by glucocorticoids.[21] There are also differences in the type of information being remembered or being forgotten while being exposed to acute stress. In some cases neutral stimuli tend to be remembered, while emotionally charged (salient) stimuli tend to be forgotten. In other cases the opposite effect is obtained.[22] What seems to be an important factor in determining what will be impaired and what will be enhanced is the timing of the perceived stressful exposure and the timing of the retrieval.[21] For emotionally salient information to be

remembered, the perceived stress must be induced before encoding, and retrieval must follow shortly afterwards.[21] In contrast, for emotionally charged stimuli to be forgotten, the stressful exposure must be after encoding and retrieval must follow after a longer delay.[21]

If stressful information is relatable to a person, the event more prone to be stored in permanent memory. When a person is under stress, the sympathetic system will shift to a constantly (tonically) active state. To further study how acute stress affect memory formation, a study would appropriate to add examine.[4] Acute stress exposure induces the activation of different hormonal and neurotransmitters which effect the memory's working processes.[23]

A study published in 2009 tested eighteen young healthy males between 19 and 31 years old. All participants were right-handed and had no history of a head injury, or of any medication that could affect a person central nervous system or endocrine system. All of the volunteers participated in two different sessions a month apart. The study consisted on the participants viewing movie clips and pictures that belonged to two different categories: neutral or negative. The participants had to memorize then rate each movie clip or picture by pressing a button with their right hand. They were also monitored in other areas such as their heart rate, pupil diameter, and stress measures by collection of saliva throughout the experiment. The participants mood was assessed by using the Positive and Negative Affect Schedule.[24]

The results from the study confirmed that there were physiological measures in regard to stress induction. The participant's heart rate was elevated and pupil dilation was decreased when viewing the pictures. The study also showed psychological measures that proved that stress induction did cause an increase in subjective stress. In regard to memory enhancement, participants that were shown a stressful picture, often remembered them a day later, which is in accordance with the theory that negative incidents have lasting effects on our memory.[24]

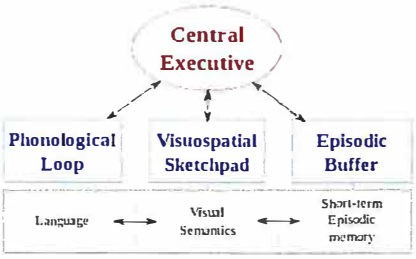
Acute stress can also affect a person's neural correlates which interfere with the memory formation. During a stressful time, a person's attention and emotional state may be affected, which could hinder the ability to focus while processing an image. Stress can also enhance the neural state of memory formation.[24]

Short-term memory

Short-term memory (STM) is the ability to store small amounts of information for a limited amount of time. The *Miller's Law* that the capacity of an average person's STM is 7±2 objects, and lasts for a matter of seconds.[25] This means that when given a series of items to remember, most people can remember 5-9 of those items, the average being 7. However, this limit can be increased by rehearsing the information. Information in STM can be transferred to long-term memory (LTM) by rehearsal and association with other information previously stored in LTM. Most of the research on stress and memory has been done on working memory (WM), as opposed to STM.

Working memory

Working memory (WM), similar to STM, is the ability to temporarily store information in order to manipulate it for performing complex tasks, such as reasoning. WM is affected to a greater extent by stress than LTM.[26] Stress has been shown to both improve and impair WM. In a study by Duncko *et al.*, the positive effect of stress manifested itself as a decreased reaction time in participants, while the negative effect of stress causes more false alarms and mistakes when compared to a normal condition.[27] The researchers hypothesize that this could be representative of faster information processing, something helpful in a threatening situation. Anxiety has also been shown to adversely affect some of the components of WM, those being the phonological loop, the visuo-spatial sketchpad, and the central executive.[28] The phonological loop is used for



Baddeley's model of working memory

auditory STM, the visuo-spatial sketchpad is used for visual and spatial STM, and the central executive links and controls these systems.[25] The disruption of these components impairs the transfer of information from WM to LTM, thus affecting learning. For instance, several studies have demonstrated that acute stress can impair working memory processing likely though reduced neural activity in the prefrontal cortex in both monkeys and humans.[29]

Long-term memory

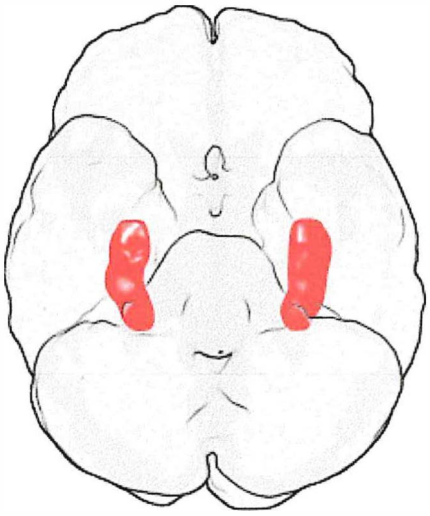
Long-term memory (LTM) is the ability to store an unlimited amount of information over long periods of time, ranging from a few days to many years.

Less is known about the effect of stress on LTM than is known about the effect of stress on STM. This could be due to the fact that LTM is not affected as severely as STM and WM are, and is also influenced by the effect of stress on STM and WM.[26]

The major effect of stress on LTM is that it improves consolidation of memory, while it impairs the retrieval of memory.[1][6][20] That is, one will be able to remember information relating to a stressful situation after the fact, but while in a stressful situation it is hard to recall specific information. In a study by Park *et al.* done on rats, the researchers found that shock induced stress caused the rats to forget what they learned in the phase prior to the shock, but to have distinct memory for where the shock occurred.[30] This negative effect on the retrieval of memories caused by stress can be attributed to cortisol, the stress hormone that is released in stressful situations. A study by Marin *et al.* demonstrated that stress enhances recall of information reviewed prior to the stressful situation, and that this effect is long lasting.[31]

Explicit memory

Explicit memory, or declarative memory, is the intentional recall of past events or learned information and is a discipline of LTM.[25] Explicit memory includes memory for remembering a specific event, such as dinner the week prior, or information about the world, such as the definition for explicit memory. When an anxious state is provoked, percentage recall on explicit memory tasks is enhanced. However, this effect is only present for emotionally associated words.[32] Stress hormones influence the processes carried out in the hippocampus and amygdala which are also associated with emotional responses.[32] Thus, emotional memories are enhanced when stress is induced, as they are both associated with the same areas of the brain, whereas neutral stimuli and stress are not. However, enhancement of explicit memory depends on the time of day.[32] Explicit memory is enhanced by stress when assessed in the afternoon, but impaired when assessed in the morning.[32] Basal cortisol levels are relatively low in the afternoon and much higher in the morning, which can alter the interaction and effects of stress hormones.[32]



The human hippocampus

Implicit memory

Implicit memory, or more precisely procedural memory, is memory of information without conscious awareness or ability to verbalize the process, and is also a discipline of LTM.[25] There are three types of implicit memory, which are: conditioning (emotional behavior), tasks and priming (verbal behavior).[33] For example, the process of riding a bicycle cannot be verbalized, but the action can still be executed. When implicit memory is assessed in tandem with stressful cues there is no change in procedural recall.[32]

Autobiographical memory

Autobiographical memory is personal episodic memory of self-related information and specific events.[25] Stress tends to impair the accuracy of autobiographical memories, but does not impair the frequency or confidence in them.[34] After exposure to an emotional and stressful negative event, flashback memories can be evident.[34] However, the more flashback memories present, the less accurate the autobiographical memory.[34] Both aspects of autobiographical memory, episodic memory, the memory system regarding specific events, and semantic memory, the memory system regarding general information about the world, are impaired by an event that induces a stressful response.[34] This causes the recall of an experience of a specific event and the information about the event to be recalled less accurately.[34]

Autobiographical memory, however, is not impaired on a continual decline from the first recall of the information when anxiety is induced.[35] At first recall attempt, the memory is fairly accurate.[35] The impairment begins when reconsolidation is present,[35] such that the more times the memory is brought to conscious awareness, the less accurate it will become. When stress is induced the memory will be susceptible to other influences,[35] such as suggestions from other people, or emotions unrelated to the event but present during recall. Therefore, stress at the encoding of an event positively influences memory, but stress at the time of recollection impairs memory.

Attention

Attention is the process by which a concentration is focused on a point of interest, such as an event or physical stimulus. It is theorized that attention toward a stimulus will increase ability to recall information, therefore enhancing memory.[36] When threatening information or a stimulus that provokes anxiety are present, it is difficult to release attention from the negative cue.[36] When in a state of high anxiety, a conceptual memory bias is produced toward the negative stimulus.[36][37] Therefore, it is difficult to redirect the attention focus away from the negative, anxiety provoking cue.[37] This increases the activation of the pathways associated with the threatening cues, and thus increases the ability to recall the information present while in a high anxious state.[36] However, when in a high anxious state and presented with positive information, there is no memory bias produced.[36] This occurs because it is not as difficult to redirect attention from the positive stimulus as it is from the negative stimulus. This is due to the fact that the negative cue is perceived as a factor in the induced stress, whereas the positive cue is not.[36]

Learning

Learning is the modification of behaviour by experience.[38] For example, learning to avoid certain stimuli such as a tornadoes, thunderstorms, large animals, and toxic chemicals, because they can be harmful. This is classified as aversion conditioning, and is related to fear responses.[39]

Fear response

An anxious state at the time of learning can create a stronger aversion to the stimuli.[40] A stronger aversion can lead to stronger associations in memory between the stimulus and response, therefore enhancing the memory of the response to the stimulus.[39] When extinction is attempted in male and female humans, compared to a neutral control without anxiety, extinction does not occur.[39] This suggests that memory is enhanced for learning, specifically fear learning, when anxiety is present.

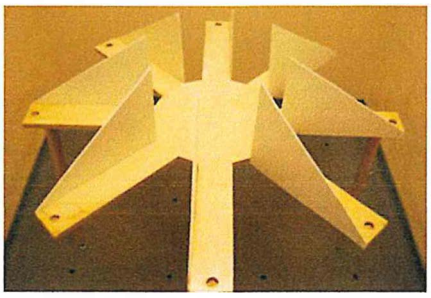
Reversal learning

Conversely, reversal learning[*What is it?*] is inhibited by the presence of anxiety.[41][42] Reversal learning is assessed through the reversal learning task; a stimulus and response relationship is learned through the trial and error method and then without notice, the relationship is reversed, examining the role of cognitive flexibility.[41] Inhibited reversal learning can be associated

with the idea that subjects experiencing symptoms of anxiety frustrate easily and are unable to successfully adapt to a changing environment.[42] Thus, anxiety can negatively affect learning when the stimulus and response relationship are reversed or altered.

Stress, memory and animals

Much of the research relating to stress and memory has been conducted on animals and can be generalized to humans. One type of stress that is not easily translatable to humans is predator stress: the anxiety an animal experiences when in the presence of a predator. In studies, stress is induced by introducing a predator to a subject either before the learning phase or between the learning phase and the testing phase. Memory is measured by various tests, such as the radial arm water maze (RAWM). In the RAWM, rats are taught the location of a hidden platform and must recall this information later on to find the platform and get out of the water.



Simple radial arm maze

Short-term memory

Predator Stress has been shown to impair STM.[30] It has been determined that this effect on STM is not due to the fact that a predator is a novel and arousing stimulus, but rather because of the fear that is provoked in the test subjects by the predator.[43]

Long-term memory

Predator stress has been shown to increase LTM. In a study done by Sundata *et al.* on snails, it was shown that when trained in the presence of a predator, snails' memory persisted for at least 24 hours in adults, while it usually lasts only 3 hours. Juvenile snails, who usually do not have any LTM showed signs of LTM after exposure to a predator.[44]

Classical conditioning

Predator stress has been shown to improve classical conditioning in males and hinder it in females. A study done by Maeng *et al.* demonstrated that stress allowed faster classical conditioning of male rats while disrupting the same type of learning in female rats.[45] These gender differences were shown to be caused by the medial prefrontal cortex (mPFC). When the researchers inactivated that brain region by administering muscimol to the females, no gender differences in classical conditioning were observed 24 hours later.[45] Inactivating the mPFC in the male rats did not prevent the enhanced conditioning that the males previously exhibited.[45] This discrepancy between genders has also been shown to be present in humans. In a 2005 study, Jackson *et al.* reported that stress enhanced classical conditioning in human males and impaired classical condition in human females.[46]

Anxiety disorders

Post-traumatic stress disorder

Post-traumatic stress disorder (PTSD) is an anxiety disorder that can occur after exposure to horrific events, or after a terrifying ordeal where there is immense physical harm that directly or indirectly affects a person.[47] When the memories of these traumas do not subside, a person may begin to avoid anything that would cause them to relive these events. When this

persists over an extended period of time, one may be said to be suffering from PTSD. Examples of events that could lead to the onset of PTSD are war, rape, assault, and childhood neglect.[48][49] It is estimated that approximately 8% of American may suffer from this disease which can lead to long-term problems.[50]

Symptoms include persistent frightened thoughts and memories of the trauma or ordeal and emotional numbness.[47] The individual may experience sleeping problems, be easily startled, or experience feelings of detachment or numbness. Sufferers may experience depression and/or display self-destructive behaviours.


Shell shocked soldiers

There are three categories of symptoms associated with PTSD:[48]

- *Re-living the event*: Through recurring nightmares or images that bring back memories of the events. When people re-live the event they become panicked, and they may have physical and emotional chills or heart palpitations.
- *Avoiding reminders*: Avoiding reminders of the events, including places, people, thoughts or other activities relating to the specific event. Withdrawal from family and friends and loss of interest in activities may occur from PTSD
- *Being on guard*: Symptoms also include an inability to relax, feelings of irritability or sudden anger, sleeping problems, and being easily startled.

The most effective treatments for PTSD are psychotherapy, medication, and in some circumstance both.[49] Effective psychotherapy involves helping the individual with managing the symptoms, coping with the traumatic event, and working through the traumatic experiences. Medications such as antidepressants has proven to be an effective way to block the effects of stress and to also promote neurogenesis.[7] The medication phenytoin can also block stress caused to the hippocampus with the help of modulation of excitatory amino acids.[50] Preliminary findings indicate that cortisol may be helpful to reduce traumatic memory in PTSD.[51]

PTSD affects memory recall and accuracy.[34] The more the traumatic event is brought to conscious awareness and recalled, the less accurate the memory.[34] PTSD affects the verbal memory of the traumatic event, but does not affect the memory in general.[34] One of the ways traumatic stress affects individuals is that the traumatic event tends to disrupt the stream of memories people obtain through life, creating memories that do not blend in with the rest. This has the effect of creating a split in identity as the person now has good memories they can attribute to one personality and bad memories the can attribute to the "other" personality. For example, a victim of childhood abuse can group their good and happy experiences under the "pleasant" personality and their abuse experiences under one "bad or wicked" personality. This then creates a split personality disorder.[52] Individuals suffering from post traumatic stress disorder often have difficulty remembering facts, appointments and autobiographical details.[53] The traumatic event can result in psychogenic amnesia and in the occurrence of intrusive recollections of the event. Children with PTSD have deficits in cognitive processes essential for learning; their memory systems also under-performs those of normal children. A study using the Rivermead Behavioural Memory Test showed that individuals with PTSD scored lower than controls on the memory test, indicating a poorer general knowledge. The study revealed that 78% of PTSD patients under-performed, and where in the categories labelled "poor memory" or "impaired memory".[53] PTSD patients were specifically worse at the prospective and orientation items on the Rivermead Behavioural Memory Test.

A few studies done in the past proved that PTSD can cause cognition and brain structure changes that involve verbal declarative memory deficits. Children that have experienced child abuse may according to neuropsychological testing experience a deficit in verbal declarative memory functioning.[50]

Studies have been conducted on people that were involved in the Vietnam War or the Holocaust, returning Iraq soldiers and people that also suffered from rape and childhood abuse. Different tests were administered such as the Selective Reminding Test, Verbal Learning Test, Paired Associate Recall, the California Verbal New Learning Test, and the Rivermead Behavioral Memory Test.[50] The test results showed that the returning Iraq soldiers did have less verbal memory performance as compared to pre-deployment.[50]

The studies performed on the Vietnam veterans that suffer from PTSD show that there are hippocampal changes in the brain associated with this disorder. The veterans with PTSD showed an 8% reduction in their right hippocampal volume. The patients that suffered from child abuse showed a 12% reduction in their mean left hippocampal volume.[50] Several of the studies has also shown that people with PTSD have deficits while performing verbal declarative memory task in their hippicampal.[50]

PTSD can affect several parts of the brain such as the amygdala, hippocampus, and the prefrontal cortex. The amygdala controls our memory and emotional processing; the hippocampus helps with organizing, storing and memory forming. Hippocampus is the most sensitive area to stress.[50] The prefrontal cortex helps with our expression and personality and helps regulate complex cognitive and our behavior functions.

Social anxiety disorder

Social anxiety disorder is an anxiety disorder consisting of overwhelming anxiety and excessive self-consciousness in everyday social situations.[54] It is an extreme fear of being scrutinized and judged by others in social and/or performance situations. This fear about a situation can become so severe that it affects work, school, and other typical activities.[55] Social anxiety can be related to one situation (such as talking to people) or it can be much more broad, where a person experiences anxiety around everyone except family members.

People with social anxiety disorder have a constant, chronic fear of being watched and judged by peers and strangers, and of doing something that will embarrass them. People that suffer from this may physically feel sick from the situation, even when the situation is non-threatening.[55] Physical symptoms of the disorder include blushing, profuse sweating, trembling, nausea or abdominal distress, rapid heartbeat, shortness of breath, dizziness or lightheadedness, headaches, and feelings of detachment. Development of low self-esteem, poor social skills, and trouble being assertive are also common signs of social anxiety disorder.[56]

Social anxiety disorder can be treated with many different types of therapy and medication. Exposure therapy is an effective method of treating social anxiety. In exposure therapy a patient is presented with situations that they are afraid of, gradually building up to facing the situation that the patient fears most.[56] This type of therapy helps the patient learn new techniques to cope with different situations that they fear. Role-playing has proven effective for the treatment or social anxiety. Role-playing therapy helps to boost individuals' confidence relating to other people and helps increase social skills. Medication is another effective method for treating social anxiety. Antidepressants, beta blockers, and anti-anxiety medications are the most commonly prescribed types of medication to treat social anxiety.[56] Moreover, there are new approaches to treat phobias and enhance exposure therapy with glucocorticoids.[57][58]

Social phobics display a tendency to recall negative emotions about a situation when asked to recall the event.[59] Their emotions typically revolve around themselves, with no recollection of other people's environments. Social anxiety results in negative aspects of the event to be remembered, leading to a biased opinion of the situation from the perspective of the social phobic compared to the non-social phobic.[59] Social phobics typically displayed better recall than control participants. However, individuals with social anxiety recalled angry faces rather than happy or neutral faces better than control participants.[60]

Obsessive-compulsive disorder

Obsessive-compulsive disorder (OCD) involves both obsessions and compulsions that disrupt daily routines and activities.[61] The obsessions include recurrent unwanted thoughts that cause compulsions, including repetitive behaviors.[62] Individuals that suffer from OCD may realize that their obsessions are not normal and try to stop their actions, but this only increases the person's anxiety towards the situation, and has an adverse effect. OCD often revolves around themes in one's life; for example,

fear of coming in contact with germs (obsession).[61] To deal with the fear of germs one may compulsively wash their hands until they are chapped. OCD is a constituent of many other disorders including autism, Tourette's syndrome, and frontal lobe lesions.[63]

A person that shows a constant need to complete a certain "ritual", or is constantly plagued with unwelcome thoughts, may suffer from OCD. Themes of obsessions include fear of germs or dirt, having things orderly and symmetrical, and sexual thoughts and images. Signs of obsessions:[62]

- fear of shaking hands with others, or touching items others have touched;
- skin conditions due to excessive washing of one's hands;
- stress when items are not orderly or neat;
- replaying pornographic images in one's head.

Compulsions follow the theme of the obsessions, and are repetitive behaviors that individuals suffering from OCD feel will diminish the effect of the obsession.[62] Compulsions also follow the theme, including hand washing, cleaning, performing actions repeatedly, or extreme orderliness.

Signs of compulsions:[62]

- washing hands until skin is damaged;
- arranging food items so that everything faces the same way;
- checking locks repeatedly to make sure everything is locked;

Behavior therapy has proven to be an effective method for treating OCD.[64] Patients are exposed to the theme that is typically avoided, while being restricted from performing their usual anxiety reducing rituals. Behavior therapy rarely eliminates OCD, but it helps to reduce the signs and symptoms. With medication, this reduction of the disorder is even more evident. Antidepressants are usually the first prescribed medication to a patient with OCD. Medications that treat OCD typically inhibit the reuptake of serotonin.[64]

Obsessive-compulsive individuals have difficulty forgetting unwanted thoughts.[65] When they encode this information into memory they encode it as a neutral or positive thought. This is inconsistent with what a person without OCD would think about this thought, leading the individual with OCD to continue displaying their specific "ritual" to help deal with their anxiety. When asked to forget information they have encoded, OCD patients have difficulty forgetting what they are told to forget only when the subject is negative.[65] Individuals not affected by OCD do not show this tendency. Researchers have proposed a general deficit hypothesis for memory related problems in OCD.[66] There are limited studies investigating this hypothesis. These studies propose that memory is enhanced for menacing events that have occurred during the individuals life. For example, a study demonstrated that individuals with OCD exhibit exceptional recall for previously encountered events, but only when the event promoted anxiety in the individual.

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https://www.rallyhealth.com/health/unexpected-effects-screen-time

RALLY

The Unexpected Effects of All That Screen Time

By Melissa Pandika | September 26, 2016 | Rally Health

The screen shows a montage of common images — a group of friends at a noodle joint, half glued to their mobile phones; girlfriends at a Colorado Rockies baseball game posing for selfies. Cut to a group of middle schoolers sitting on a park lawn. A boy with glasses and wiry sandy hair says screen time "distracts you probably from what's more important, and yet you still can't get off of it." A slim, ponytailed girl adds, "It pulls you in." The boy agrees strongly, "It *pulls* you in."

It's a common observation. When physician and filmmaker Delaney Ruston found out that kids spend an average of 6.5 to 8 hours a day looking at screens, as a doctor she wondered: "What impact does all this screen time have on health?"

Ruston investigates this question in her documentary *Screenagers*, which explores how young people use digital devices and the possible effects on their brains. She discovers digital media use can produce a drug-like effect, felt at any age but most intensely during the teenage years. When parents abruptly take away the device from their child, a meltdown typically ensues. "I think so many parents are feeling out of control," Ruston says.

We spoke to Ruston and other experts about the adverse health effects of screen time from childhood through adulthood.

Adults

A 2014 Nielsen report found that adults log a total of 11 hours of screen time a day. Here are some of the ways this might be adversely affecting our health:

- **Vision.** Staring into a screen for extended periods of time can cause "computer vision syndrome." You're probably familiar with the symptoms: strained, dry eyes, blurred vision and headaches. Poor posture can also cause neck and shoulder pain.

- **Sleep.** Studies link heavy computer and mobile phone use to more sleep disturbances. University of Gothenburg psychologist Sara Thomée, one study's lead researcher, explains that the blue light emitted from the screens of digital devices suppresses the sleep-promoting hormone melatonin, keeping us from restful sleep.

- **Addiction and reward seeking.** Dopamine, the aptly-called "feel-good hormone," is part of the brain's pleasure and reward circuits. Playing video games turns on similar brain regions as those linked to cravings for drugs and gambling, Ditto for social media — every time we see a new post or get a reaction to ours, it's like a hit of brain candy.

- **Weight.** Even two hours of TV a day can increase the likelihood of weight gain, diabetes, and heart disease in adults. (Computer use doesn't seem to have as strong a link.) There are probably several factors to blame, including less active time, less sleep, and seeing more ads for unhealthy foods.

- **Overall health.** Most of the time we are on our screens, we are sitting down. Sitting for hours at a time boosts the risk of obesity, heart disease, type 2 diabetes, and some types of cancer. One study found that spending more than four hours a day in front of a computer or TV more than doubles your likelihood of dying or being hospitalized for heart disease — and exercise won't reduce the risk. Check out **our infographic** for more information.

Tweens and Teens

During the preteen and teen years, the human brain goes through major transformations to achieve maturity. This may be why tweens and teens are especially vulnerable to the impacts of screen time on brain function and emotional well-being.

- **Learning.** One study found that kids and young adults who spend a lot of time on TV and video games were twice as likely to suffer from attention disorders. "Anything that affects attention affects learning," says Victoria Dunckley, an integrative child, adolescent and adult psychiatrist and author of *Reset Your Child's Brain.*

- **Self-confidence.** More time watching videos or other content on digital devices means less time exploring and creating their own experiences, stories, or projects. "I think the key to develop self-competence and self-confidence is creating," qualities important for healthy relationships and overall well-being, Ruston says.

- **Social skills.** Online experience can help build community and foster communication and creativity. But as *Screenagers* points out, tweens or teens may hide behind screens to avoid tricky or awkward conversations, like approaching a crush or making new friends. "Rather than challenge themselves to do that in person,

they go to the screen for a diversion," Ruston says. That lack of face-to-face interaction can also feed online bullying.

- **Emotions and personality.** In 2010, researchers found that kids who logged more than two hours a day in front of a computer or TV screens had a higher chance of psychological difficulties on a standard questionnaire. Studies in young men show that playing violent video games is clearly linked to more aggression and less sensitivity to others. Also, imaging studies have found that internet addiction and game addiction can visibly shrink the brain regions most responsible for planning and executive functions, empathy, compassion, and impulse control.... It is not clear how quickly or easily the brain returns to a "normal" state after you stop playing video games, Dunckley says. On the other hand, some games that reward cooperation and mutual support can reduce stress, boost mood, and promote helping behaviors.

- **Addiction and reward seeking.** A recent survey revealed that 50 percent of U.S. teenagers admitted being addicted to their mobile devices. Ruston learned that the brain's dopamine center is extra sensitive during the teen years, making the rush of playing video games feel even more intense and addictive.

- **Sleep.** Similar to findings in adults, screen time in teens can have damaging effects on sleep. A 2015 study of 10,000 16- to 19-year-olds in Norway reported that those who clocked in four or more hours of screen time a day (outside of schoolwork and homework) had about a 50 percent higher likelihood of lying awake for an hour or more before finally falling asleep. According to a recent study, lack of sleep in teenagers is strongly linked to more risky behaviours like drinking and driving.

- **Weight and overall health.** Just like in adults, watching two or more hours of TV is linked to weight gain in teenagers. Studies have also noted higher cholesterol and blood pressure in those who watch more TV.

Young children

Our kids are swimming in screens. According to a recent study, 92 percent of babies had used a mobile device before their first birthday. Close to 35 percent have their own mobile device at age 2, and that number is 75 percent in 4-year-olds. Nearly a quarter of children ages 2 and under have TVs in their rooms, and at age 4, almost 50 percent do. Pertaining to this, the American Academy of Pediatrics Studies reports that screen time may be affecting the normal development of fundamental learning, language, and emotional skills.

- **Learning.** Kids younger than 30 months have a limited ability to learn from videos, according to some studies. They learn more from live interaction with people, plus immediate feedback. The American Academy of Pediatrics discourages active media use by children under 2 and says there is no proven educational or developmental benefit at this age. Screen time also takes away from unstructured play time, which is important for learning and problem solving.

- **Language skills.** Research has clearly shown that TV can impair language development in kids by displacing time spent interacting with caregivers. Digital devices have a similar effect. “TV reduces speech between parents and their infants and toddlers,” explains David Hill, chair of the American Academy of Pediatrics Council on Communications and Media Executive Committee. “It’s really that casual, everyday speech that helps them develop language skills.”

- **Emotional development.** Some experts worry that using digital devices as "shut-up" toys to occupy kids during day-to-day tasks like shopping or eating out might prevent them from learning how to regulate boredom, distress, and other impulses and emotions.

- **Vision.** In recent years, many nations are experiencing epidemic levels of myopia, or short-sightedness, and indoor time may be to blame. In Seoul, South Korea, for example, 96.5 percent of 19-year-old men wear glasses. Researchers think it may be due to lack of exposure to sunlight, which might be important for proper vision development. In a 2013 study, teachers at a Taiwanese school made kids stay outside for their entire 80-minute recess period (instead of letting them stay inside). Only 8 percent were diagnosed with myopia a year later, compared to 18 percent at a neighboring school.

- **Sleep.** Research has linked screen use among children with shorter, lower-quality sleep. A 2014 review paper of school-aged kids and adolescents correlated screen time with poorer sleep. They saw especially strong links between screen time and delays in bedtime, as well as a shorter period of time spent sleeping. A study published a year later found that compared with kids who didn't sleep near a small screen (like a cellphone screen), those who slept near a small screen reported about 20 fewer minutes of sleep and were more likely to report insufficient rest or sleep.

- **Weight.** Several studies have found that the more TV children watch, the more like they are to be overweight. Kids with TVs in their bedrooms are more at risk, and childhood TV habits affect the risk of being overweight as adults.

The common theme across age groups: More screen time means less time for activities that are good for your health and well-being. The most important question to ask yourself is, "What is screen time displacing?" Hill says. — "Is it displacing sleep, communicating with each other as a family, exploring the world and exercising?"

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Recenze Marek Preiss

Manfred Spitzer: Digital dementia: What We and Our Children are Doing to our Minds. Brno: Host, 2014

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Manfred Spitzer's book from 2012 called *Digital Dementia* (Brno: Host, 2014) is remarkable, brilliantly-written and well translated. The author is a German neuroscientist and psychiatrist in a leadership position. By the book title – digital dementia – Spitzer refers to the term *digital emigrants* that labels a generation of people born after 1980. This generation grew up with computers as a natural part of life. Spitzer primarily disapproves of excessive playing of computer games, relying on the ease of obtaining information and external information sources that replace deeper understanding. Since the publication has received a number of reviews even in the Czech press (to say nothing of foreign countries), it is very likely that this book will influence the opinion of the general public. And because it also affects the computer rehabilitation, we should become familiar with the author's opinion.

Since the beginning, Spitzer makes it clear that he is prejudiced against the digital media (e.g. he uses sentences like "Compared to the real world, there is more lying and cheating in the internet environment and this in turn affects our own behavior" (p. 70) or "If you want your child's school results to get worse, buy him (or her) a video game console." (p. 184). Nevertheless, his prejudice is based on long-term interest in the issue. Arguments such as "Digital media are causing the decline of education among young people" (p. 200) and "at a closer inspection, repeated praising of the digital skills of the young generation vanishes into smoke" (p. 193–194) extend throughout the book. The book is dominated by a warning message: "those who spent a lot of time using audiovisual media in early childhood have already affected the brain development, especially the normal development of speech" (p. 269).

Spitzer presents the internet addiction as a warning sign for the future. In South Korea, approximately 12% of schoolchildren are addicted to internet (p. 70). In 2009, the US children spent in average 11 times more time watching television (approximately 4.9 hours per day) than reading a book (p. 14). In Germany (2009), the average student of the ninth grade spent 7.14 hours with electronic media (television, video, DVD, chatting on the internet, computer games; this does not include mp3s and mobile phones).

Spitzer claims that the brain behaves like a muscle; it grows when used and atrophies when not used. Cognitive training takes place automatically during the mental and physical effort. Mental effort lies in the active dealing with the world. Mental efficiency is related to the amount and depth of the mental tasks/actions performed. Computers are not optimal teaching aids, because learning process requires an independent mental work and a deep engagement in learning. The deeper we get engaged in learning the better we manage it. The depth of mental work is replaced by digital shallowness. The praised multitasking actually represents attention deficit disorder. Digital media cause problems with self-control. The excessive use of digital media is related with undesirable phenomena such as obesity, stress and sleep disorders.

According to Spitzer, there is no evidence that modern information technology used at schools would improve the teaching. On the contrary, it leads to superficiality. If we count on finding all information on the web or in the computer's memory where they are stored, it weakens the motivation to remember new knowledge. Relying on external resources leads to weakening the knowledge. Thereby, it reduces the possibility of a future independent intellectual work. When comparing use of a pencil and use of keyboard, writing with pencil activates the brain better. The combination of fine motor skills and learning is more effective than static observation of a screen. The use of digital media creates only few sensorimotor effects and thereby contributes to the decline of education. Computer games, especially the violent ones, promote violence in society. Video game consoles support poorer school performance. If we want a meaningful use of computers at schools, we need pedagogical concept and appropriately trained teachers above all. As an argument Spitzer uses the results of studies in which the use of computers led to attention disorders at an early age and to learning disabilities at preschool age. Nevertheless, he does not believe that digital media could accelerate, deepen or otherwise improve the process of brain education (p. 195). Spitzer says that those who want to get information about the real state of things must go through a 150-year-old process of understanding called Hermeneutic circle. It refers to the idea that the whole is established by reference to the individual parts and the individual parts are established by reference to the whole – the acquiring of real knowledge does not happen through surfing on the internet but through active learning. Saving substantive content in brain depends on the depth of processing. Because of the new digital media we do not need new universities. Learning takes place only if there is a personal relationship between teacher and student – a teacher who manages to inspire the student.

According to Spitzer, people who access the virtual world by just one click, are significantly less capable of thinking about this world that those who try to understand the real world. Apart from the research studies the author cites even personal experiences of people who write to him: they mention that the longer they use the internet the more difficult is for them to focus on writing longer passages of text. Spitzer argues that when relying on external aids such as computers, more errors occur than during specific measurements. He also compares measuring with a tape/ruler and measuring with the use of computer program.

In one chapter Spitzer focuses on multitasking. He argues that the much praised multitasking works negatively against another significant process, cognitive control, and that a long-term multitasking can train the attention (as the admirers of these parallel processes say) but also disturb it. He shows it on a study that uses n-back: here, multitaskers had worse results than non-multitaskers. Spitzer interprets this study in a way that people using multiple media at the same time are less able to subdue irrelevant stimuli.

The author also tries to draw conclusions from the rapidly growing number of computers in households. In the 80s people who bought computers has usually better school performance that the others. According to a PISA study, 20 years later, people who own a computer have poorer school performance (p. 115). The main reason of these results is the fact that the computer is primarily used for playing computer games.

Spitzer presents the risks to relationships between people and to social behavior. Intensive use of online social networks reduces the number of real friendships, limits social competence and atrophies the areas of brain that are responsible for this behavior (p. 116). He believes that young people know less and less how a real relationship works; the internet is full of negative social contacts.

Those who are interested in computer rehabilitation could be also interested in the chapter called "training the attention on computer" (pp. 226–227) where the author quotes a study made by Green and Bavalier that was published in Nature journal. This study was testing the impact of playing action games on attention and actually proved that the effect is positive. Spitzer disputes the results and shows that in fact the players of shooting

games "voluntarily weaken their attention and self-control and thereby lower themselves to a mental level of an automatic machine" (p. 228).

Furthermore, he quotes the results of another British study (Owen et al., 2010) from Nature journal in which over 52 000 people were examined using 4 neuropsychological tests and then divided into 2 experimental and 1 control group. Both experimental groups were doing for the period of 6 weeks computer training sessions (3 times a week, at least 10 minutes a day, an average of 24 sessions on the computer), the control group did not do any computer training. Over 11 000 people completed the training. In all three groups, there was a slight improvement in neuropsychological tests. Therefore, when compared to the control group the training did not bring any significant change. The authors of the study say that although we can not exclude the possibility that similar approaches such as cognitive training with a coach can be beneficial in certain cases, we believe that our results confirm that 6-week computer training brings nothing more than answering simple questions concerning general knowledge using the internet." According to Spitzer computer training is not effective for the brain. The general mental performance would not improve and "except these fact, the long-term effects of the time spent on computers and on the internet (either work or free time) has not been properly examined." Rather problematic is the selection of just one study out of a large number of studies dealing with the effectiveness of computer rehabilitation. The subjects trained at home with minimal training quality control and with varying degrees of training frequency. Spitzer thus neglects a number of other studies of better quality.

All in all, the book is readable and it summarizes the information that are rather scattered in other literature. The author's enthusiasm and beliefs are evident. If filmed Spitzer's book would be very close to the vision of the movie Idiocracy (2006, directed by Mike Judge) which impressively portrays the future dumbness of humanity, reduction of average intellect, primitiveness and materialization.

In the opinion of the computer rehabilitation reviewer, the book mainly claims:

1. Computer training "contamination" by other digital media is very serious methodological problem that can negatively affect the results of training. If children/adults apart from computer training "consume" other technologies collaterally or serially it is very likely that focused attention on training will be dissipated. Presumably it can weaken the training results but it may also amplify them (which goes against Spitzer's assumptions). Anyway, we do not know how the use of other digital technologies affects the computer training. Maybe the future studies should focus on how our performance gets affected when we use other technologies in addition to computer training.

2. Spitzer omits the results of other studies that deal with cognitive rehabilitation. E.g. n-back he mentions himself is the basis of a number of rehabilitation methods (Cogmed, the programs of Anna Páchová in Czech Republic). Dozens of studies with Cogmed program predominantly confirm the effectiveness of working memory training. There is an agreement on the supposition that training memory is the essential cognitive function and a condition for the ability to concentrate. The Czech program by Anna Páchová is aimed at the working memory training and has been tested in Czech and Romani children. The author found significant improvement in both groups in memory tests solving. Effect on intelligence was found only in Romani children.

3. Spitzer laughs at the idea that computer training can prevent dementia. In his opinion, there is no proof of positive, to real life transferable and perceptible effects (p. 282). He considers the training literally "useless": "If you are serious about the brain jogging that should improve your psychic condition when you retire, turn off the TV or computer screen, invite your grandchildren and go with them for a walk in the

woods" (p. 283). In this case, Spitzer does not show any significant evidence that would prove his arguments wrong. Proven evidence of the efficiency of reduced risk of cognitive decline (non-computerized, especially mnemonic memory training) is seen as high compared to other examined factors such as eating vegetables, Mediterranean diet, omega-3 fatty acids, physical activity and leisure time activities (Williams et al., 2010). However, a number of studies have proven the effectiveness of computer-administered cognitive rehabilitation, for example Cha and Kim (2013). Although some questions remain unresolved – especially the quality of transfer to untrained areas and the question of long-term gains from the training – at least the short-term effectiveness of computer training is largely considered proven.

4. Spitzer tries to look at the comparison of training effectiveness in training supervised by a human coach and computer training. There is a study that compares the effectiveness of cognitive rehabilitation of speech under the supervision of a therapist vs. computer rehabilitation. This study discovered similar results in both devices (Schoenberg et al., 2008). Other attempts try to enable control over persecutory hallucinations using computer software with an "avatar" – a computerized alter ego of the patient's psychotic hallucinatory pursuers (Leff et al., 2013).

Spitzer rightfully warns against the superficiality caused by the excessive exposure to digital media, however, he ignores the possibilities that could bring the proper use and appropriate application of digital media.

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