

# The Science Behind Doodling

**2019 Report**

The  
Doodle  
Challenge





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**Principles for the Development of a Complete Mind: Study the science of art. Study the art of science. Develop your senses- especially learn how to see. Realize that everything connects to everything else.**

*- Leonardo da Vinci*



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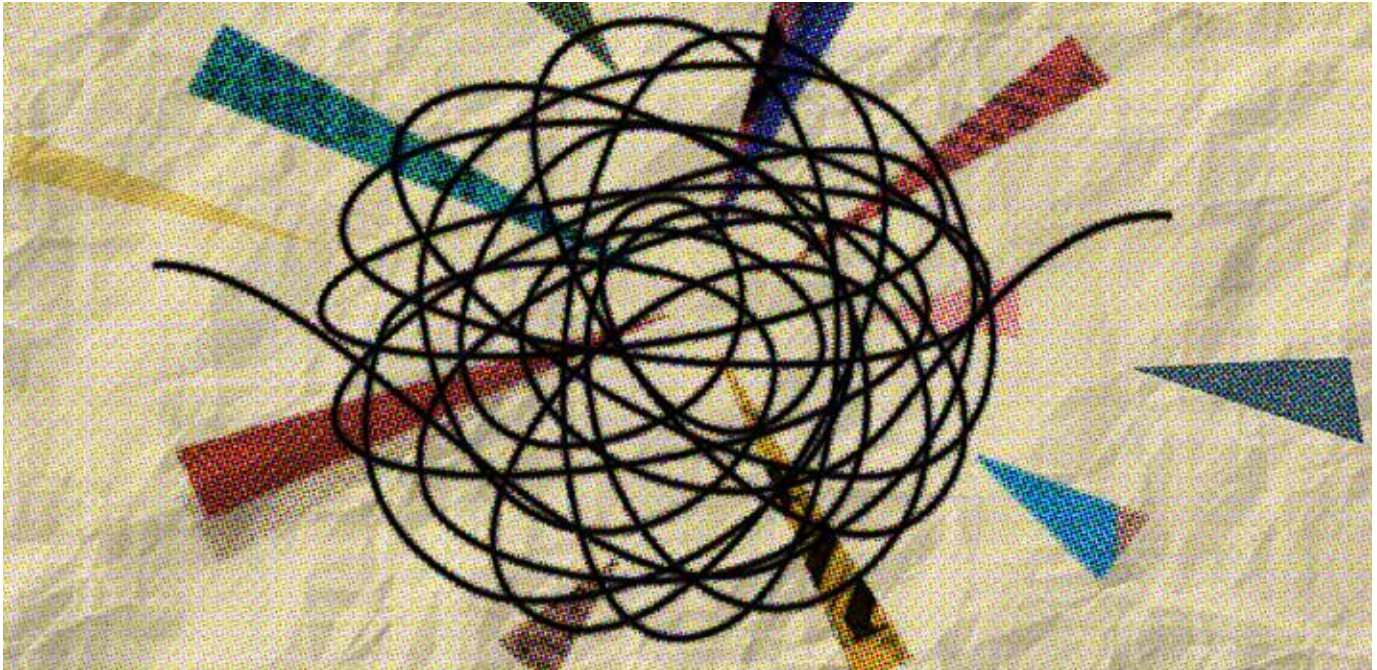
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## Taming the Health Epidemic of the 21st Century with Doodling

Stress has emerged as a widespread health risk worldwide. The extent of this is captured when, according to the World Health Organization (WHO), stress has been described as the “health epidemic of the 21st century”. From a cognitive standpoint, landmark theories of psychological stress were developed - beginning in 1951 - stating that stress happens when individuals experience a demand or threat whilst having insufficient resources to cope with these demands or ameliorate the threats<sup>1</sup>. It can be argued that the increased prevalence of stress correlates with the mechanics of a rapidly changing way of modern life, in which stressors associated with more demanding workplaces, widening income inequality, a more socially connected world, as well as

a rise in unhealthy lifestyles all become more prominent.

Creative Arts Therapies (**CATs**) are emerging as novel interventions to both manage and prevent stress, by accessing functional circuits in the brain via creativity centered activities - such as nonverbal mark-making – to access emotions and change behavior.

Doodling is one such CAT that has recently gained traction in the scientific literature as being an effective tool in taming stress, and its common resulting offshoots: self-doubt, disconnect, and burnout.

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**Stress has been described as the health epidemic of the 21st century.**

- *World Health Organization*

## Stress is a Major Global Health Concern

Government health organizations, academic institutions and, the World Health Organization have published many reports that warn of the increasing prevalence of stress, particularly in the workplace<sup>2</sup>. According to the 2017 'Stress in America' survey carried out by the American Psychological Association (APA), **61%** of Americans identify work as a common source of stress<sup>3</sup>. The impact of stress is both psychological and physiological; it manifests as exhaustion, anxiety, burnout, self-doubt and a weakened immune system.

# 61%

of Americans identify work as a common source of stress<sup>4</sup>

Stress-induced absence from work is costly for worldwide economies. A survey of U.S. workers by Mental Health America estimates this cost to employers at approximately **\$500 billion** annually. An analysis of cost-of-illness (COI) studies by researchers at the University of London estimate the total cost of work-related stress to approach **\$200 billion annually**<sup>4</sup>. A report by The National Institute for Occupational Safety and Health (NIOSH), part of the Center for Disease Control (CDC) revealed that in the workplace, **40%** of people reported their job as being very or extremely stressful, and **25%** view their jobs as the number one stressor in their lives<sup>2</sup>. Stress at work invariably shows a tendency to translate to that at home – a longitudinal study of 471 employees showed that over time, job demands and lack of resources at work had a negative impact on personal

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**A survey of U.S. workers estimates the impact of stressed out employees costs employers approximately \$500 billion annually.**

- *Mental Health America*

functioning and general happiness in the home domain<sup>5</sup>.

The physiological impacts of stress can be vastly destructive, and avenues of research that focus on the relationship between stress and the immune system have shown an exacerbation of pro-inflammatory states in response to stress<sup>6,7,8</sup>. It has also become clear that the immune system has a closer link to the nervous system than previously known; and with stress directly perpetuating an inflammatory response, a form of inflammation termed neurogenic inflammation can rapidly propagate in the nervous system<sup>9</sup> and damage the structure and function of neural circuits, in turn compromising neuroplasticity: the function of perceiving, responding and adapting to stimuli<sup>10</sup>.

## Stress Contributes to Self-Doubt, Disconnect, and Burnout

When stress is left unchecked or mismanaged, it can feed into distinct states of physiological and psychological discomfort. Those states can also manifest

on their own, or in tandem with each other. In addition to stress, we identify **self-doubt**, **disconnect**, and **burnout** as key targets that need to be addressed.

The stress response is a normal physiological function - much like acute pain being a response that warns us of danger – and is the first line of defense in dealing with a challenging situation, whether it be an environmental event, or a psychological thought process.

By way of this hard-wired system, stress is detected by a small region called the amygdala in the brain, which sends a signal to a similarly small, almond-sized region of the brain called the hypothalamus. It rings a bell, signaling the nearby pituitary glands to release hormones that communicate with the adrenal glands above the kidneys to further release an array of stress hormones, including adrenaline and cortisol. This hypothalamus-pituitary-adrenal (HPA) axis works quickly to prime your body to deal with the situation at hand: the heart rate is increased; blood pressure is elevated; glucose energy supplies are released into the bloodstream and the immune system is modulated. This cascade happens so quickly that it precedes processing in the visual cortex. The nervous system is also primed by activating regions in the brain that process fear, motivation, and mood. Bodily functions that are not required during this *fight-or-flight* period are switched off; these include suppression of the digestive system, growth processes, and the reproductive system.

Following a stress response, hormone levels return to normal, and the bodily systems that were altered return to baseline. It is when stressors are present more frequently, that the stress-response system becomes activated long-term, and unwanted disruption to psychological and

physiological processes causes chronic **stress**, **self-doubt**, **disconnect**, and **burnout**.

From a psychological standpoint, an emotion like **disconnect** constitutes part of a survival response that averts someone from a perceived stressful situation. Engaging with work, and personal responsibilities can sometimes become unwanted stressors and trigger the stress response when it shouldn't be activated. The result can be an avoidance of these activities – becoming disconnected - and procrastinating by being readily prone to distraction by surroundings and thoughts.

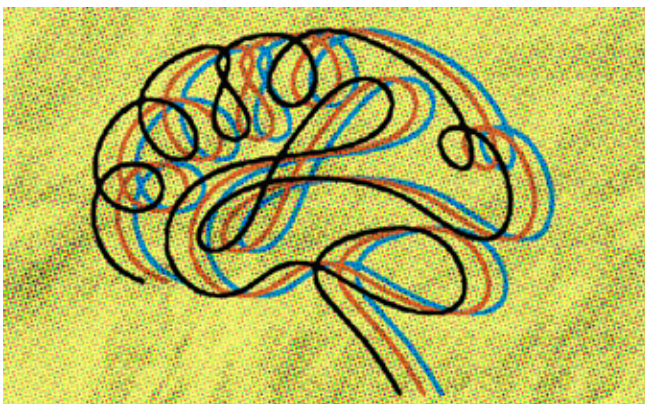
The destructive – albeit biologically protective – messages of stress and disconnect feed directly into a perception of **self-doubt**. When an individual is in a state of stress and disconnect, and their cognitive response is to avoid and delay things that have become stressors for them, ideas of self-doubt creep in, and self-confidence and determination wane.

**Burnout** – a term coined in 1974 by Herbert Freudenberger<sup>11</sup> - presents after a relatively prolonged experience of stress in the workplace, or domestically. The body is in a state of emotional and physical exhaustion after enduring the bodily responses of long-term stress. The key signs that an individual is entering a state of burnout include depleted physical energy, exhaustion, and a distancing from the work that is required to be completed – in the form of disconnect, self-doubt, apathy and an increasingly pessimistic outlook. A three-year study tracked the health-impairment processes of burnout, depression, commitment and work engagement and found that job resources impacted disconnect and commitment, and job demands was a predictor of burnout over time<sup>12</sup>.

## The Science behind Doodling: A Creative Art Therapy Intervention to Tackle Stress and its Offshoots

### What is Doodling?

Doodling can be defined as the act of physically drawing – anything, be it scribbles, shapes or other forms - in an idle state of mind; a state where you are not directly thinking about what is being produced on the surface that is being doodled on. You'll see the drawing or mark-making, perhaps even in a semi-conscious way, but there will not be a transfixion or focus on this. Another distinction of a doodle compared to extended periods of drawing is that it is very often a short period of 'mark-making' – a term used to describe any combination of lines and patterns created on a surface.



### How is Doodling Manifesting in the Brain?

Doodling has been found to activate a part of the brain that regulates and dampens the stress response – the prefrontal cortex. It is involved in a wide variety of functions that constitute our highest-order cognitive abilities, including: regulation of emotional reactions, complex planning, coordinating and adjusting behavior, computing

simultaneous streams of information whilst ignoring distractions – functions that relate closely to what constitutes stress, self-doubt, and disconnect. Thus, the finding that the prefrontal cortex is activated in the brains of people who were doodling<sup>13</sup> is of vital importance. This study was the first of its kind to examine the brains of people completing drawing tasks, including doodling, and view the activation of specific regions using functional near-infrared spectroscopy (fNIRS). They found that the medial prefrontal cortex was activated in a group of participants that included people who identified as artists, as well as non-artists. The observed activation of reward pathways in this region of the brain is significant because it is implicated with high-order cognition that can be targeted with a doodling practice.

So, what could this activation be doing? The brain has a remarkable ability to re-form neural pathways, termed plasticity, or neuroplasticity. The neural pathways between the amygdala – that detects stress – and the prefrontal cortex can become damaged in response to prolonged stress. Additionally, it has been found that stress exposure has a detrimental effect on the structure and function of the prefrontal cortex<sup>14</sup>. It can be thus be hypothesized that the act of doodling is an intervention capable of enabling neuroplasticity and repairing damage caused by stress, much like activities such as exercising do so<sup>15</sup>.

### Studies Show That Doodling Lowers Stress, Self-Doubt, Disconnect and Burnout

The functional imaging study<sup>13</sup> that shows activation of the prefrontal cortex following doodling can be strengthened further by many studies reporting participant response

data that shows a lowering of our key targets: stress, self-doubt, disconnect and burnout. And interestingly, in this study itself, the research participants self-perceptions relating to problem-solving and having good ideas improved, indicating that their feelings of self-doubt were reversed.

In a broad review of the literature, Lily Martin and colleagues found that from 37 independent studies, **81.1%** of participants reported a significant reduction of stress<sup>16</sup>. A randomized controlled trial carried out on 50 participants looked at the effects of art production on negative mood, and found that producing art had a dramatic reduction in negative mood<sup>17</sup>.

# 81.1%

37 independent studies, 81.1% of participants reported a significant reduction of stress after doodling.<sup>16</sup>

In addition to psychological studies investigating stress that utilize self-reporting and brain imaging, another objective measure of stress is quantifying the primary stress hormone, cortisol. In one such study, following a session of art making, 39 healthy adults exhibited significantly lower levels of cortisol<sup>18</sup>. It is a remarkable example that shows the immediate efficacy that an intervention centered around mark-making can have on body physiology.

To demonstrate how disconnect can be tackled, a study was carried out whereby research participants completed a comprehension task. It was found that **29%** more information was recalled by the group that was doodling<sup>19</sup>.

It was found in another study, that scribbling notes longhand helps to improve cognition.

A UCLA study by Pam Mueller and Daniel Oppenheimer discovered that students who took notes longhand performed better on conceptual questions than those who took notes on laptops<sup>20</sup>. It can be hypothesized that had functional imaging been carried out on the participants taking notes longhand, the prefrontal cortex would be more active than the group taking notes on their laptops.

In a conceptually related study, a problem-solving exercise was presented to engineers in four different ways: ranging from no graphic data at all, to all available graphic data. It was found that the graphic representations of problems resulted in teams being most successful in producing better results<sup>21</sup>.

The scientific literature is hence supportive of cognitive art therapies, including doodling, to have beneficial effects on lowering stress, self-doubt, disconnect, and burnout.

## Everyone Can Benefit From a Doodling Practice: Our Brains are the Same

There appears to be a common misconception that people who doodle are by default creatives. This has been disproved. In fact, everyone doodles, because it is an activity that is not dependent on artistic ability. One study with over 1000 participants found that **86%** of employees from an analytical and information technology profession reported that they doodle<sup>22</sup>.

The incidence of doodling was reported by participants in many professional sectors, such as education, art and design, business and financial, as well as personal care and service. Additionally, the spread of participants was diverse in terms of



education level – almost equally split by participants who had a bachelor’s degree (**34%**), a master’s degree (**27%**), or some college experience (**23%**). The remaining **16%** of participants had received only high school or PhD training.

Moreover, despite common-held belief, there is no such thing as a ‘left-brained’ or ‘right-brained’ person. This classification is widely used to split people into left-brain or right-brain dominant groups based on their personality and patterns of cognition, but research shows this is not accurate.

University of Utah neuroscientists published a study<sup>23</sup> that analyzed 7,000 brain regions of more than 1,000 people while they completed various tasks – there was no evidence that study participants had a predominantly left or right-sided brain network.

Everyone is prone to stress. And everyone can use doodling as an effective intervention to tackle it.

## **KLS Score: A Tool for Measuring Levels of Stress, Self-Doubt, Disconnect and Burnout**

How can you gauge your own levels of stress, disconnect, burnout and self-doubt? The Doodle Challenge team has developed a research tool called the Key Levels Score (KLS). It is comprised of twelve questions designed to score each of these four parameters separately and has been structured based on existing peer-reviewed psychology research<sup>24-26</sup>. The tool is presented in an easy-to-use web app, and answers are entered by selecting one response from the following options: never, almost never, sometimes, fairly often and very often. These responses are translated

to a scoring system ranging from 0 (never), 1 (almost never), 2 (sometimes), 3 (fairly often) and 4 (very often). The responses are analyzed and presented as a cumulative Key Levels Score, whereby a higher number denotes an increased level of combined stress, disconnect, burnout, and self-doubt. The score is further broken down into each of these key levels and visualized to report the extent of these individual parameters. The individual key level scores of stress, self-doubt, disconnect, and burnout can be presented in various combinations to highlight specifically which aspects of stress require the most attention.

The KLS is designed as a tool to provide you a snapshot of your levels of stress and its offshoots and can help guide your approach to bringing these levels down. We suggest The Doodle Challenge game as an effective Rx to accomplish this.

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**The KLS is designed as a tool to provide you a snapshot of your levels of stress and its offshoots, and can help guide your approach to bringing these levels down.**

*- The Doodle Challenge Team*

The Key Levels Score is available to take by visiting:

[www.thedoodlechallenge.com/KLS](http://www.thedoodlechallenge.com/KLS)

## The Doodle Challenge Game: The Rx for Stress, Self-Doubt, Disconnect and Burnout

We have developed **The Doodle Challenge** as both an exciting game and a cognitive art therapy tool for adults to play in a group or solo, that can combat stress, self-doubt, disconnect and burnout. A version has also been developed for children, that has been adjusted for complexity, with the rationale that cognition is still in a developmental phase. The game can be played solo, or in groups, in many creative ways. In addition to targeting the key psychological factors we have described, the game also hones storytelling skills, which are essential for enhancing effective communication and problem-solving, as well as bolstering creativity.



**The Doodle Challenge** game invites you to: (1) Explore the Doodle (2) Complete the Doodle and (3) Name Your Doodle. A deck of dry-erase cards contains a marking that serves as a starting point for a doodle. It is in this phase that the cognitive process of doodling is manifesting in the prefrontal cortex of the brain and linking to circuits that will dampen stress. Next, the brain will shift into an active, creative phase where we invite you to complete a drawing based on the initial doodling.

The marks are given meaning, and in this process, storytelling and creative thinking skills are nurtured. Some of the cards are worth more points than others, depending on the starter marking, and they can be positioned in any way to begin the doodle. Once a player is satisfied that they have completed their card, they have the opportunity of naming the doodle. The coalescing of psychological and brain imaging research into doodling has elucidated both a widespread effect of stress-reduction and remarkably, mapped it functionally to an area of the brain that is a crucial hub of high-order cognition. It is here that complex behavior, personality expression, decision making, and social behavior is planned and processed. Brain regions that detect and process stress integrate closely with this hub, and it governs and regulates the stress response.

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**I developed The Doodle Challenge as both an exciting game and a cognitive art therapy tool for adults that can combat stress, self-doubt, disconnect, and burnout.**

- Christina Kaputsos  
Founder - The Doodle Challenge

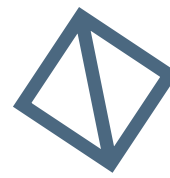
**The Doodle Challenge** game leverages the neurological benefits of doodling by feeding into this brain-functional response to lower stress, self-doubt, disconnect, and burnout.

So let's doodle and reverse the major health epidemic of this century.

# Summary

Doodle has been utilized by humans from our early days.

The Doodle Challenge continues to conduct research to further understand the relationship of doodling and the brain. We have developed a series of products and we're currently working on an exciting app to further enhance the doodle journey!



# About the Authors



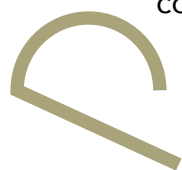
**Christina Kaputsos**  
Founder - The Doodle Challenge

For the past decade, as a creative director and strategist, she has worked for and consulted a range of clients including startups, fortune 500 companies, tech brands, consulting firms, educational institutions, NGOs and the US government. Previously as an educator and program director, she developed curricula for children, teens and adults students, both local and international. Global in her perspective, she has worked in New York, Washington DC and London. She is an honors graduate of the Maryland Institute College of Art, with a Bachelor of Fine Arts. She is trained in Illustration, Design Thinking and is UX Certified. Passionate about aiding individuals in better understanding themselves and unlocking their creativity, She created TDC to reduce stress in teams and individuals caused by work/life situations that can impact cognitive function and artistic expression.



**Muzamil Saleem**  
Neuroscientist & Writer

Muzamil is a writer and researcher on the The Doodle Challenge team. He is currently finalizing a Ph.D. in neuroscience, focusing on both further understanding the immune response to chronic pain, as well as leveraging it to deliver targeted nanomedicine. His scientific research career has spanned laboratories at King's College London, University of Pittsburgh and Duquesne University, where he has regularly published in peer-reviewed journals in the fields of Alzheimer's disease and chronic pain. He is passionate about leveraging his diverse experience and knowledge, as well as his creative passion, to both advance and communicate the amazing science happenings in laboratories across the globe.





## Contact Us

To learn more and start **The Doodle Challenge**, visit us at:

<http://www.thedoodlechallenge.com/>

To speak to our team about **The Doodle Challenge** for organizations (businesses and schools)

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# The Doodle Challenge

**A game for thinking  
outside the lines.**

**[www.thedoodlechallenge.com](http://www.thedoodlechallenge.com)**

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