

# Cognitive Effects of Changes in Geography for Places of Work and Learning during COVID-19

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## Introduction

The devastating impact that the COVID-19 pandemic has brought onto individuals is yet to be fully explored. This paper attempts to review some of the potential cognitive effects that have resulted from having to continue working and learning remotely. In addition, it will examine how COVID-19 has affected individuals who have lost the opportunity to work and/or learn remotely.

The economic and psychological impact that the COVID-19 pandemic has inflicted on populations does not go unnoticed for most people around the world. Everyone has had at least one person that they know who has been affected or knows of someone who knows of someone who has been affected by it or unfortunately has even been affected themselves. There is growing evidence that suggests that all we can really do is just to contain the spread of the virus as opposed to eliminating it. It will unfortunately be amongst the vast diseases that we have to live with, once we can figure out a way to continue with 'normal' life. The amount of stress that this has caused and continues to cause for employers, employees and the various families that are supported by employers and/or employees

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is immeasurable. The stress particularly in cases where it is prolonged will have adverse effects on cognition and overall health. This coupled with other factors such as reduced mobility, reduced face-to-face social interactions, reduced finances, increases in debt amongst other things creates a compounding effect in terms of the net psychological impact, which can then translate into short-term to potentially longer-lasting cognitive effects.

## Effects of Stress Responses on Cognitive Function

For most people the home environment is regarded as a place of safety and security. With the recent changes in terms of the arrangements that have had to be made in order to somewhat continue with 'normal' practices of work and learning remotely. It has changed our personal spaces from places of comfort to places that we can now associate with work-related stress. Living spaces play a big role in how we feel. In a study conducted by Goto, *et al.* (2013) they found that exposure to organized gardens can affect both the mood and cardiac physiology of elderly individuals. Their data further suggests that these effects can differ depending on the types of landscapes to which an individual is exposed to. Therefore, with these findings we can see how living spaces have an effect on mood and how by extrapolation we can attribute certain stressors to specific environments and how we perceive them.

If we are not talking about COVID-19 we are most likely talking about the stress that the virus is causing in its various forms for each of us as individuals. What is stress? Stress is sometimes confused as a state of mind associated with a sense of panic that occurs in brief moments throughout our lives. It is not entirely that simple to define as it can also extend from that. A more scientific definition can be provided that explains stress as being a highly individual experience that does not depend on a particular type of event such as a time pressure, but rather, depending

on specific psychological determinants that trigger a stress response (Lupien, *et al.*, 2007).

Stress can be absolute, a real threat, such as being involved in a car accident or it can be relative, a threat which is implied, this is prompted by how an individual perceives a situation such as speaking in front of a large audience (Lupien *et al.*, 2006). With these two definitions of stress the absolute form of stress takes precedence over the latter as it speaks more to circumstances that an individual has less control over. However, individuals are also able to desensitize themselves from their stress responses over time through repeated exposure under controlled conditions (e.g. exposure therapy). We cannot deny that stress is a normal and an essential part of being a human. We generally need a certain amount of stress in order to have the required attention to complete a certain task (Neethling, 2005). Stress can either be positive or negative. Negative stress, also known as distress, is the main concern of this paper as it is characterized by individuals who experience emotions of anxiety or worry that can lead to reduced cognitive abilities in certain contexts. This can be accompanied by fatigue, chest pain, headaches and other psychosomatic symptoms. Positive stress (eustress), on the other hand, is characterized by individuals experiencing an exciting event, which leads to feelings of happiness or a feeling of being glad (Jarinto, 2011; Seyle, 1976).

According to Lupien *et al.* (2007) stress was originally defined in engineering literature to describe the force experienced by structures as a result of strain. It was later then adapted by Selye (1998) to explain how humans could physiologically experience stress. He mentioned that stress could be described as being a “non-specific phenomenon representing the intersection of symptoms produced by a wide variety of noxious agents” (Selye, 1998, p. 210). Selye (1998) then tested various conditions in order to simulate a stress response examples including the following: fasting, extreme cold, operative injuries, and drug administration. In performing these various activities, Selye (1998) was trying to produce morphological changes in the body that were representative of a stress response. Later the work of Mason (1968) found the description to be a narrow interpretation

of what stress is as it relates to the human experience as stress is not limited to what objects can physically do to humans to produce a stress response but also what events can do as well in terms of the subjective psychological experience that can then produce a stress response. According to Mason (1968) and Selye (1975a,1975b) in further studies it was confirmed that the determinants of stress responses are highly specific, and therefore, potentially predictable and measurable.

The stress response is the main concern of this paper. The body's response to stress, particularly distress, has an impact on cognitive function (Selye, 1975a, 1975b, 1998). With the need to move towards the remote mode of teaching and learning as well as working, it has brought about an entirely new set of unique challenges on top of an already stressful situation for most people. Trying to deal with these stressors becomes another challenge on its own because of the prolonged exposure to the stress hormones in cases where individuals cannot manage with the difficulties and subsequent stress associated with working from home. There are also individuals who are also finding themselves unemployed and unable to make ends meet, they are also at heightened risk as many traditional practices in many organizations that were the norm pre-COVID-19 are now rapidly changing in order to meet the challenges of the current context, but more interestingly, a reimagining of how these practices should look like post-COVID-19 is also taking form. The persistent exposure to stress hormones, as discussed earlier, can then result in reduced cognitive function. "The reason for this is that the stress hormones that are secreted in response to an absolute or relative stressor are steroids that can easily cross the blood-brain barrier and access the brain, where they can influence learning and memory by binding to receptors localized in various brain regions known to be involved in learning and memory" (Lupien *et al.*, 2007, p. 211).

Significant stress responses during the formative years of an individual's life such as in their childhood and adolescence has implications as it relates to the risk of the manifestation of depression and psychotic disorders later in their adulthood, researchers suggest that it is likely due

to the effect of excessive amounts of glucocorticoids on the neural networks, which then results in the “loss of synaptic spines and in some cases whole dendrites of pyramidal neurons in the prefrontal cortex” (Bennett, 2008, p. 1075). The prefrontal cortex is the most vulnerable region of the brain as it is the most sensitive to stress (Arnsten, 2009). In addition, the conscious control of how we receive information under stressful conditions, has been associated with the activation of the anterior cingulate cortex, it is involved in certain higher-level functions, such as attention allocation, reward anticipation, decision-making, ethics and morality, impulse control (e.g. performance monitoring and error detection) and emotion. (Botvinick, *et al.*, 2001), which if prolonged results in decreased activity of the prefrontal cortex, associated with cognitive functions (Frieze, *et al.*, 2013). In addition, low self-esteem, which many people around the world may be experiencing in excess of during the COVID-19 pandemic is a reliable way of detecting a proclivity to stress sensitivity, it has been correlated with reduced hippocampal volume in both young and elderly individuals (Pruessner, *et al.*, 2004). The hippocampus plays an important role in the consolidation of information in short-term memory and in spatial memory that enables navigation however not the priming and procedural memory (Cohen & Eichenbaum, 1993; Kinsbourne & Wood, 1975; O’Keefe & Nadel, 1978; Squire & Zola-Morgan, 1991, p. 632; Holdstock *et al.*, 2000b, p. 627; Aggleton & Brown, 1999; Kinsbourne & Wood, 1975; O’Keefe & Nadel, 1978; Squire & Zola-Morgan, 1991; Vargha-Khadem *et al.*, 1997, p. 632).

The effects of stress on how the mind behaves, as an example such as on performative tasks such as memory, attention, and those of higher cognitive functions that have more of an influence on important day-to-day decisions are well known to be influenced almost always negatively and constitute the top-down approach meaning having an effect on decision-making behavior (Starcke & Brand, 2012). In a general sense, judgment and decision-making behaviors reveal a pattern of scanning memory or strategies which “under stress tend to become more rigid with fewer alternatives scanned” (Staal, 2004, pp. 1075-1076).

## Changes in Geography for Places of Work and Learning

Since the beginning of the phasing in of lockdown regulations in the early months of 2020 for South Africa and most countries around the world, various measures to ensure effective social distancing was implemented. Some of these in hindsight now seem draconian as they have had devastating economic impacts and in turn various other adverse impacts. However, South Africa had a unique opportunity in terms of how it could approach the COVID-19 pandemic, in that it had the opportunity of first learning from countries in the global north. This has resulted in more ostensibly decisive decisions, by the government, that has in turn avoided a much bigger crisis. The National Institute of Communicable Diseases (NICD) reported on their website (<https://www.nicd.ac.za>) that “a 38-year-old male who had travelled to Italy with his wife and a group of 10 people had arrived back in South Africa on March 1, 2020”. He was later on the 5<sup>th</sup> of March 2020 confirmed to be positive for COVID-19 by the NICD through a public notice published by the Minister of Health – Dr Zweli Mkhize.

In order to ensure ‘normal’ operation of business and schooling an acceleration into the Fourth Industrial Revolution (4IR) has had to be implemented. This was of course subject to infrastructure availability. South Africa in this case is at a particularly disadvantaged position in terms of its ability to accommodate an acceleration into the 4IR. This is due to the limited radio frequency (RF) spectrum allocation. It was announced nearly a decade ago regarding the intention to increase the RF spectrum allocation. The Department of Communications (DoC) as it were at the time spoke of the “intention to make Policy Directions to the Independent Communications Authority of South Africa (ICASA) on exploitation of the digital dividend spectrum (790-862 MHz) and RF spectrum (2500-2690 MHz) for electronic communications services” (Masonta, *et al.*, 2012, p. 5). This has still not been realized (that being the licensing of a greater RF spectrum allocation) and as a result has limited

the broad accessibility of electronic communication services, particularly to the less-privileged members of the society due to high data prices. The data prices are high because there is low traffic on the telecommunications network, meaning, for telecommunication companies to be profitable, they have to make data prices high. With more traffic (which is currently not possible due to the limited RF spectrum allocation) telecommunication companies can then begin to lower data prices making it more cost-effective for customers and therefore increasing price elasticity which then allows telecommunication companies to be more economically viable in the shift to lowering data prices for customers.

Now as we see the shift to models of working from home enabled by telecommunication infrastructure it has put the less-privileged at a disadvantage in terms of the threshold to entry for the world of work as it is, currently, during the COVID-19 pandemic. In addition, individuals have lost the opportunity to work due to redundancy, in some cases, or have even unfortunately lost their lives due to severe illness coupled with an under pressure public health care system and/or as a result of depression that has led to some cases of death by suicide. These various issues that have arisen (or at least exacerbated) as a result of the pandemic. This has resulted in serious mental health concerns such as increased stress as discussed earlier, sadness, worry, fear, anger, annoyance, frustration, guilt, helplessness, loneliness, and nervousness amongst others (Mamun & Griffiths, 2020). These are the common markers of an individual who typically suffers from mental health issues. They are likely to be the symptoms experienced by many individuals during the period of the COVID-19 pandemic (Ahorsu *et al.*, 2020; Banerjee, 2020; Cheung *et al.*, 2008; Xiang *et al.*, 2020). In extreme cases, such as those that arise from mental health issues, these can then lead to suicidal behaviors (e.g., suicidal ideation, suicide attempts, and actual suicide).

It is well established that around 90% of suicides occurring around the world are as a result of individuals suffering from mental health conditions such as depression (Mamun & Griffiths, 2020). Similar circumstances have been reported in previous pandemics as well. As an example,

the suicide rate amongst the elderly increased in Hong Kong both during and after the SARS (Severe Acute Respiratory Syndrome) pandemic in 2003 (Cheung *et al.*, 2008). No viable cure was found for this disease so it is likely that the Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which is the strain of coronavirus that is responsible for the coronavirus disease 2019 (COVID-19). The respiratory illness responsible for the COVID-19 pandemic will likely be a disease that would be in the best interests of the global community to overcome through alternative methods apart from just waiting for a cure, which is proving to require more time than we have. Beginning with the process of recovering from the effects of the COVID-19 pandemic by way of finding ways to continue with 'normal' life while living with virus in our societies will prove to be the best approach for the global community. One way would be by containing the spike in infections as and when it occurs so as to prevent further adverse effects onto individuals, particularly those in vulnerable positions in society.

Students are the second subset of individuals in the South African population that this paper focuses on as it relates to the concerns raised by the effects caused by the COVID-19 pandemic. Employment prospects for the youth population in South Africa is incredibly bleak with individuals in this category being employed at a rate of less than 50% (Statistics South Africa, 2020). The persistently high youth unemployment of individuals in South Africa remains a concerning issue as the youth are essentially an important population group in terms of driving economic growth and productivity. In the first quarter of 2020, Statistics South Africa (2020) reported that 63,3% of youth (15-34 years) make up the total number of unemployed persons. The effects of COVID-19 since the first quarter of 2020 in South Africa has certainly negatively impacted the ability of the market to absorb more individuals into the workforce. The full extent of this impact is still yet to be evaluated. The main concern of this section of the paper is the way in which COVID-19 has affected students. It lies once again in the limited infrastructure of telecommunication companies in South Africa. This has resulted, as discussed, in high costs to



the purchasing of data creating barriers to entry in terms of the ability of students to be able to comfortably shift towards the remote mode of teaching and learning that has largely taken place in most tertiary institutions. Even in cases where data provisioning has been made available for students, the limited network coverage of telecommunication companies in South Africa still affects some students from seamlessly engaging in the remote teaching and learning approach that tertiary institutions in South Africa have adopted. The failure of the telecommunication companies to drive the relevant stakeholders to assist in increasing capacity in terms of RF spectrum allocation has been one of the main reasons behind South Africa's inability to accelerate towards the 4IR despite its enthusiasm for it. In addition, the limited network coverage particularly in more remote and peri-urban areas remains a challenge to students currently engaging in the remote teaching and learning approach as adopted by most tertiary institutions in South Africa.

An overwhelming majority of students currently enrolled in tertiary institutions in South Africa come from poor to middle-class households making the move as it were towards remote teaching and learning particularly challenging for students. This coupled with limited resources such as devices, network coverage, the adjustment to the 'new' mode of teaching and learning and various other context specific challenges put this category of students at a unique disadvantage. The mode of assessments is another point of contention that will surely have an impact in terms of how universities ensure students are engaged in authentic learning experiences that are also supported by assessments that help to foster an environment where the academic integrity of results is maintained. Can we consider assessments particularly those conducted remotely as true assessments? Are students disadvantaged through remote teaching and learning intervals? Does the remote teaching and learning approach pose threats to the financial sustainability of universities? These are some of the questions that are still yet to be answered as a new paradigm in how teaching and learning intervals ensues. It is likely that this form of remote teaching and learning will continue post-COVID-19 in some form given

how various institutions that were predominately more adept to contact sessions have now developed ways of integrating a remote teaching and learning approach. At the very least a hybrid form of this approach should and will likely continue.

The advent of the COVID-19 pandemic has not been all bad news. There has been a major cultural reprogramming that many proponents of the 4IR have been waiting for. The shift in the paradigm of how things ought to be has resulted in an acceleration into where we should have already moved into given the available infrastructure (albeit limited). Businesses or places of work no longer need to have the conventional model of requiring employees to be present in an office in order to perform their work duties. They can do the same work they did in the office, now, at home as well. This gives employees the flexibility of setting their own working hours and saving business' overhead expenses as well as saving employees time and money traveling to and from work amongst other things. Over 70- 80% of MTN's employees, across their 21 markets, have managed to successfully transition to the working-from-home approach since the beginning of the more stringent South African lock down regulations in March, with engineers who work on network towers and the other remaining workforce making up the rest of the employees that have to report to duty as per usual (CNBC Africa, 2020).

## Mental Health

As discussed earlier most recorded suicide cases around the world are as a direct result of individuals suffering from a mental health condition such as depression (Mamun & Griffiths, 2020). These cases are of a greater concern in a period such as the COVID-19 pandemic because of the limited social interaction that is promoted by the law and various health authorities in an effort to contain the rate of the rise of infections. The trauma associated with the COVID-19 pandemic will likely exacerbate existing mental health conditions (Montemurro, 2020). Humans are a naturally social species and as such, anti-social behaviors aids in further

exacerbating an already dire situation in terms of an already concerning mental health state, particularly with regards to individuals who have dependents like those who have to now, navigate through the current state of having to work remotely with its challenges that have been discussed earlier as well as students who for the most part in South Africa are first generation university students whose families depend on their success for their economic stability and livelihoods. Tertiary level students in the United States of America (USA) are amongst the most vulnerable population group with regards to suicide risk. Suicide is amongst the top 10 of overall leading causes of death in the USA, and the second leading cause of death amongst college students (American Foundation for Suicide Prevention, 2019; Centers for Disease Control and Prevention, 2017).

“The first South African Youth Risk Behavior Survey (YRBS) in 2002 (Reddy *et al.*, 2003) reported similar findings but at considerably higher rates. In the six months preceding the survey 19% of learners considered attempting suicide, 16% reported having made a plan to commit suicide and 17% made one or more attempts to commit suicide (Reddy *et al.*, 2003). Disturbingly, these rates had not improved in the 2008 survey conducted six years later (Reddy *et al.*, 2010). Amongst the risk factors for suicide is previous mental illness especially depression, alcohol and substance abuse and previous attempts at suicide” (The South African Depression & Anxiety Group, 2015; James *et al.*, 2017, p. 779).

“The prevalence of reported feelings of hopelessness or sadness amongst school going learners in developed and developing countries is high, as reported in the US YRBS 2013 29.9%, El Salvador 32.2%, and across six African countries 46.1%” (Centers for Disease Control & Prevention, 2013; Peltzer, 2009; Springer, *et al.*, 2006; James *et al.*, 2018, p. 779).

The rates of adolescents living in more vulnerable settings such as the informal setting of Kamala was much higher (Swahn, *et al.*, 2012). The risk factors for mental health issues like suicidal ideation and attempt are as a result of various factors that include the following: “biological, psychological, cognitive, social and family factors” (Page *et al.*, 2006,

p. 779). The manifestation of depression and anxiety at the same time in adolescents is likely to also form feelings of hopelessness (Iliceto *et al.*, 2011). Feelings of hopelessness has also been used as a reliable predictor of suicidal ideation and suicidal attempt (Beck, *et al.*, 1975; Nkansah-Amankra, *et al.*, 2010; Walsh & Eggert, 2007). Risk behaviors such as tobacco, alcohol and drug use amongst other things appears to have a significant impact on adolescent health issues (Page *et al.*, 2006). Moreover, feelings of sadness or hopelessness is also correlated to the development of adolescent mental health issues (Page *et al.*, 2006). These risk behaviors are at a heightened risk as a result of the pandemic due to the severe toll it has had so far for many individuals and families around the world making mental health awareness that much more important than it was previously for most people. Individuals in low- and middle-income countries (LMICs) such as South Africa generally tend to have a stigma towards mental illnesses and as a result will generally not seek professional help. This is mainly due to financial constraints but even in cases where services are provided more affordably or even free-of-charge the general attitude towards treating mental illnesses as real illnesses that need the same attention as any other serious illness is often neglected.

Myers *et al.* (2018, pp. 1797-1798) shed some light on this sensitive issue in South Africa in their 'patient preferences for the integration of mental health counseling and chronic disease care in South Africa' article:

In line with the WHO guidelines for reducing the mental health treatment gap in LMICs, South Africa has endorsed task-sharing of basic mental health counseling from specialist mental health to non-specialist health providers, such as nurses, lay counselors, and community health workers employed within PHC services. Evidence is accumulating that it is feasible to task-share mental health counseling within PHC services in LMICs and that task-shared interventions are potentially effective for treating depression, alcohol use, and other common mental disorders. Despite this evidence, it is not certain how chronic disease patients will perceive

screening for alcohol problems and depression and the offer of counseling within a task-sharing framework.

What this shows is that interventions have been put into place to see to it that some form of assistance is provided to those who need it most. However, because of the prevailing stigma, the uptake of mental health counselling remains poor, particularly amongst chronic disease patients (Myers *et al.*, 2018). More recently, mental health services were made available within the public health care system in urban and peri-urban areas in order to assist more individuals. South African psychologists and psychiatrists have been reported to be offering private pro bono interventions through their professional associations to people affected in the COVID-19 pandemic (Naidu, 2020).

## Conclusion

South Africa as well as most parts of the world are still reeling from the devastating effects of the COVID-19 pandemic. Millions have lost their livelihoods, lost their insurance, lost their homes, lost their peace amongst many things. Despite all this loss, the mantra that still prevails is “forward we go.” This may be the best we have. After all this is not the first pandemic the world has faced. South Africa is still dealing with many issues related to its health sector, such as the prevailing epidemic of the Human Immunodeficiency Virus (HIV) / Acquired Immunodeficiency Syndrome (AIDS) and Tuberculosis (TB). Not to mention the many other issues of the various other sectors that has stifled meaningful growth in South Africa. Africans were also faced with the looming threat of the Ebola virus wiping out millions of people from the face of the continent. We’ve managed to be resilient in the face of these adversities. The COVID-19 pandemic, is yet again, another test of the resilience of the people of Africa. Will we manage to overcome this pandemic?

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