To What Extent Does Technological Overstimulation Affect Productivity?

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ABSTRACT

This research paper investigates the consequences of technological overstimulation on productivity. By establishing a structural basis of the conscious and subconscious effects of technology usage on the mind, through the effects of artificial stimuli on Dopamine release and the myelination of neural pathways, a proportionate relationship between varying degrees of overstimulation and a person's productive output can be determined: signified by fluctuations in the quantity or quality of one's work.

Introduction

As a fundamental building-block of human existence, stimulation is what causes people to engage in certain activities, and act in the ways they do. A stimulant can be anything which, by definition, causes someone to become 'more active or enthusiastic'[1], both physically and mentally, and therefore any information entering the brain may have a stimulating effect. An immediate example may be a person which regularly takes part in a sporting activity: due to the fact that this stimulates their brain positively, they choose to repeat the process. Thus, the brain reacts positively and negatively to different stimuli, and this causes people to form their own individual desires and preferences as every activity stimulates a person's brain to a different extent. Whilst a person may enjoy the stimulation which comes from playing sports, this doesn't mean that they will enjoy gardening equally. Concurrently, stimulation is viewed in a highly positive scientific light, as engaging in positively stimulating activities is believed to immensely strengthen mental health and cognitive function. In a report by the Medical School at Harvard University, positive stimulation was described as paramount to delaying cognitive decline and keeping one mentally sharp for longer[2], in addition to reducing stress, anxiety and depression risk.

However, there are negative effects which can occur when a person becomes 'overstimulated'; this research paper will explore these, focusing specifically on technological overstimulation, and draw any parallels, if possible, between an increase in overstimulation and a shortfall in productivity (defined as 'the effectiveness of productive effort'[3]).

What is technological overstimulation?

Over-stimulation may occur due to many things; it is defined as "being stimulated mentally or physiologically to an excessive degree[4]", by the Oxford dictionary. Whilst this definition will suffice, I will extend this definition, to "being stimulated mentally or physiologically to an excessive degree by an excess of information", as whilst this is accounted for originally, it should be highlighted for the purpose of this essay. Quintessentially, overstimulation occurs when the brain attempts to process too much information, leading to a decline in cognitive function. This decline can be seen through increases in stress, fear and anxiety, and difficulty focusing[5]. Due to the nature of overstimulation, it is a highly common phenomena in new-born babies, which have not mentally developed to the extent where large quantities of information can be processed[6]. This is becoming increasingly common in young adults, too: when looking at the presence of technology in our modern lives, it becomes apparent that society has formed a great dependency on such technology. And whilst it has benefitted society in many ways - enhancing our creativity and interconnection socially; allowing education to improve dramatically and be more accessible - its complete integration into our everyday lives has brought with it a plethora of flaws - with overstimulation in a new, technological form being one of the most prominent. Plainly, technological overstimulation is when a person interacts with technology too frequently, or for extensive periods, which leads to them suffering the side-effects discussed prior, notably a decrease in the ability to focus.

How does technological overstimulation occur?

Globally, people spend on average 6 hours 58 minutes of their day looking at screens[7]. This usage is increasing too: recent figures, from statisticians at Exploding Topics, suggest that the average person's daily screen time has increased by nearly 50 minutes per year since 2013[8]. This excessive screen time can be damaging to the brain, as by being online and using technology for such large proportions of our day, we expose ourselves to far greater quantities of information. Take the phone, for example: if, as Apple released in January 2023, the average 16 – 64-year-old does spend 6 hours and 58 minutes looking at screens, predominantly their' phones, then we must consider how this would stimulate the senses in order to determine the root of the overstimulation. When using a smartphone, switching through apps or websites quickly will mean lots of colour change coming from the screen. This artificial light varies in wavelength and frequency, and therefore the brain must process this. There will be constant flows of text to be read, from receiving messages to flicking through web articles. Notifications will cause the phone to beep or vibrate, given the default settings, and this not only causes the brain to think about the content of the notification, distracting the user from the task they were originally doing, but will also often cause the user to pick up their phone and engage with it again, in order to see what the latest activity is. If this was to be done for 6 hours and 58 minutes per day, then it is understandable why over 4 in every 5 Americans says they have felt overstimulated[9], as the brain is forced to process a barrage of information which it is not supposed to. Due to this fact, State Farm, one of the largest and most trusted life insurance companies within the USA, reports that excessive phone usage leads to 'poor sleep' and 'concentration and learning issues'[10]. By drawing parallels between this report and the content of the previous paragraph, namely how overstimulation can lead to lower focus and stress, then it becomes clear that technology can be a significant source of overstimulation.

The effect of overstimulation on dopamine release

Dopamine is a modulatory neurotransmitter secreted within the brain from the hypothalamus[11]. It is the hormone which gives us 'pleasure': when we engage in an activity which is stimulating, it will be released as part of the brain's reward system. These stimulating and exciting experiences, or pleasurable ones, trigger the release of dopamine, and it can be released in small or large quantities[12]. This causes the person to feel happy, and pleased, and consequently they will want to engage in such activities repetitively. Normal levels of dopamine are credited with boosting motivation and happiness[13], whilst a deficiency in dopamine can be known to cause depression. As can be imagined, dopamine in the right quantities has a very positive effect on the human brain and is essential to living a high-quality life. As dopamine is the hormone which causes us to take pleasure from engaging in certain activities, it is consequently responsible for causing us to desire partaking in things, as the brain will associate certain activities with releasing higher amounts of dopamine. This therefore leads us to want to engage in certain activities over others, as we feel we will gain a greater degree of pleasure from them[14]. This is the basis of how humans choose to spend their free time. Dopamine may therefore be rebranded as the desire chemical, as our brain's craving for its release makes us desire to do the activities which it thinks will release it over others. A good example of an activity which stimulates dopamine release would be taking part in physical activity: if a person has had to put in large amounts effort to engage in and complete the activity, then the dopamine 'reward' will be greater. This causes a large amount of dopamine to be released upon completion of the activity.

However, activities such as scrolling social media or watching Netflix are not as rewarding. Activities such as these require very little, if any, effort to engage in, but still cause our brains to release dopamine as it finds them stimulating and exciting. This offsets the brain's dopamine balance as it releases large quantities of dopamine which have come with very little effort, whereas previously there had been a mechanism in place in order to ration dopamine release. Engaging in technological activities will release a 'slow drip' of dopamine, unlike the large amount after partaking in an effort-requiring activity, which builds up over time to be an excessive quantity. In turn, one may start to choose these 'slow drip' activities over more difficult tasks, as they gain the same amount of pleasure without having to put in any effort. This can lead to technology having a quasi-monopoly over our actions, as we deem using it to be highly rewarding and therefore will choose to use it instead of doing other things[15]. A prime example would be the mobile phone: The brain finds using the phone exciting, and stimulating, and therefore encourages us to do so more often. This is why people generally, particularly within teen years, find themselves instinctively reaching for their phones, whenever there is nothing more stimulating to be partaking in, as it can always be relied upon for a quick release of dopamine. Whether it is the anticipation of wanting

to receive another text message, or snapchat, or to just scroll through social media or the news: through repeated use, our brains have now come to associate mobile phones with dopamine-releasing media which give us pleasure. This causes society to use them more and more, which is why, according to the screen-time monitoring app Locket, the average person has been shown to check their phone up to 150 times per day[16] on average, with the cited report taking into account every time a person would interact with their phone's lock-screen over a standard week.

In the 1950s, renowned psychologists James Olds and Peter Milner designed an experiment to show the effect of effort-free dopamine on the behaviour of rats. The holding chamber was modified 'so that a lever press would deliver direct brain stimulation through deeply implanted electrodes[17]'. This led to the rats pressing the lever up to 7000 times per day, due to the feeling of pleasure which the lever delivered[18]. The results of this were so dramatic, that female rats would neglect their new-born nursing pups in order to press the lever, and some rats would 'self-stimulate as often as 2000 times per hour for 24 hours, to the exclusion of all other activities'. Whilst an extreme example, this experimentation highlights the nature of excessive dopamine release on brain and allows certain parallels to be draw with human behaviour when using technology.

As seen through Olds and Milner's work, when provided with such a low-effort, accessible source of dopamine, the rats would stop partaking in other positive activities as they did not gain the same pleasure from it. In humans, this could correlate with a lack of incentive to be productive and work hard, as they do not receive an immediate and adequate amount of pleasure from doing so. In turn, one's motivation would decrease to do such things, as seen in the case of the rats, and productive output will decrease. These dramatic changes in behaviour may be brought back to the idea of stimulation: the excess amount of dopamine released by our interaction with technology is due to the large amounts of information we receive, such as in a television show which is fast paced. The brain finds this stimulating, and therefore it is due to our own technological overstimulation that the brain becomes so highly attracted to these activities and the dopamine they release.

The effect of overstimulation on the attention span

As established, technology has become ingrained within the intricacies of society. At the institution where I study, Shrewsbury School, the majority of work is completed in online notebooks; homework will be set online and most work will have to be submitted online. Whilst this is beneficial for time-saving and efficiency, this means concurrently that large amounts of time are spent using technology by modern day students, and technology has become an unavoidable element of our lives.

By having phones within our pockets constantly, a person can always reach for their phone if they feel that they will gain an immediate 'hit' of pleasure. Doing this habitually can cause this to become an impulse – the brain's natural response – to being bored. In turn, this can cause one's attention span to decrease, as people are able to go less and less time focused on one task without feeling an impulse to do something else, such as reaching for their phones, as their brain perceives it as being more stimulating than the current activity. By my own hypothesis, society has developed a phobia of being bored. This theory is supported by substantial evidence too: according to a paid article by Adweek, the average attention span has shrunk from 12 minutes to only 5 over the past decade[19]. Another report states that, as of 2022, "People were more likely than not to feel their attention span is shorter than it used to be (49% vs 23%)[20]". Whilst being shocking statistics, they also prove highly revealing when looked at in greater depth: the example prior noted a 7-minute decrease in the attention span, or 58%, however the time period of this statistic also appears to coincide with a recent rise in technology usage. Quartz.com finds that since 2011, mobile phone usage has increased by nearly 10 times[21]. When taking this into consideration with the recent decline in attention span, it becomes difficult to ignore parallels between the two timeframes. In a 2022 study by King's College London on decreasing attention spans, it was found that "50% say despite their best efforts they sometimes can't stop checking their smartphones when they should be focusing on other things"[22]. This summary of the report showcases the exact effect of technology on our brains: as the brain finds tech to be highly stimulating due to the large quantities of information it gives us, the brain anticipates a release of dopamine whenever we use it. In turn this causes us to impulsively check our devices, as we deem these mediums as being an immediate source of pleasure and engagement. Examples of these impulses are checking our phones for texts, and instinctively refreshing email mailboxes. This leads to less focus on the task at hand, and therefore less productivity.

Using 'Deep Work' to increase productivity

To provide some context to this notion, it is important that deep work is discussed. 'Deep Work', coined by author Cal Newport as the title of his book discussing the subject, is definable as "a state of peak concentration that lets you learn hard things and create high quality work quickly"[23]. Famously championed by Newport, who is referenced closely within this section, it is a technique which professors and research-university students use to maximise their work output whilst leading incredibly busy lives. The basic theology of deep work is that if one can minimise the distractions around us, they will be able to work at a higher level of concentration/focus and therefore be able to increase their productive capacity. In order to achieve a state of deep work, one must work in a completely distraction-free environment. This means that phones cannot be easily accessible, as submitting to an urge to read a text message would break the deep focus. In addition, all background noise and other distractions should be negated, meaning that the person can work in an undistracted state for a chosen amount of time.


Carl Jung's lakeside retreat.[24]

One example of deep work's power is the career of prolific intellectual Carl Jung. Born in 1875, he was a psychologist and psychiatrist, and is credited with founding analytic psychology. His work has been influential in far more fields than just his own, with many hailing his contributions about personalities and consciousness as transcending his profession into religious and literary debates. He has received honourary doctorates from Harvard university, the university of Oxford and the university of Geneva[25]. One of the key elements of Jung's success was his absolute devotion to deep work; this devotion was to the point where Jung constructed a stone tower (as shown above) on the lake of Zurich in a small town of Bollingen, where he would retreat to practice deep work. It is recorded that at 7am, "after a big breakfast he (Jung) would spend two hours of undistracted writing time in his private office"[26]. By doing this, Jung was able to produce large quantities of high quality, undistracted work which cemented him as one of history's greatest intellectuals. It was by doing this, that Jung was able to release 6 ground-breaking works within 10 years[27] which argued against the widespread belief in the works of Sigmond Freud. By proposing such high quality arguments in his work, he was able to disprove Freud and have his ideas become mainstream. This was no easy task, and it was through such intense focus that Jung was able to produce these world-changing works.

Another example of a deep work devotee is Jason Benn. Shortly after starting his work as a financial consultant in 2001, he decided that it wasn't the right career for him, and that he wanted to be a computer programmer to add value to the world and his life. Generally, beginner developers will study a 4 year course at university, and then attempt to compete for the top jobs. However, Benn, admitting himself, 'didn't have this time as he had already spent 4 years getting a college education'. Because of this, he determined that he would have to teach himself this new skill, and fast. However, having worked in an office - constantly being online and checking his emails on a computer - he found it difficult to concentrate on work tasks for extended periods of time. Benn described himself in his office work as spending "98 percent of my time surfing the web"[28], which is a common symptom of dopamine addiction and overstimulation as has been previously discussed. Benn consequently decided that the only way to master the new skills he wanted to learn, was to teach himself to work deeply. He achieved this by locking himself in a room with 'no computer: just textbooks, notecards, and a highlighter'[29]. Whilst this was initially difficult, Benn eventually was able to work for 5 successive hours without break. As a result of this, after only 2 months of studying, Benn took part in the notoriously intense Dev Bootcamp, a software engineering course which one student with a PhD from Princeton described as the 'hardest thing they had done in their

life'. Regardless, with Benn's mere two months of deep work in learning code, he was able to graduate at the top of his class[30].

If we are to contrast the cognitive intensity of working deeply, to working in a highly distracted environment, it becomes clear that the prior leads to a far greater degree of productivity. Whilst practicing deep work can be an extreme form of work, it allows the greatest productivity level due to the great degree of focus which it requires. Concurrently, there must be a form of work at the other end of the spectrum, which requires very little focus. This is distracted work, which we will all succumb to if we work in a highly distracting environment and give in to our impulses to check our phones, for example. If we are to draw conclusions from this spectrum, and if distracted work is the polar opposite of deep work, then it could surely be concluded that distracted work will be less productive, and less efficient.

The neuroscience of overstimulation

It must be understood that this divide between the two polarities of work-intensity is not an imaginary phenomenon, constructed by theoreticists. By looking more intensely at the neuroscience behind learning new skills, this can be proven from a scientific standpoint as well.

Myelin is a layer of fatty tissue that grows around neurons in the brain, which acts as an insulator that allows electrical impulses between cells to fire faster and more efficiently[31]. Whenever a person works on a specific subject, they trigger cells called oligodendrocytes which begin wrapping layers of myelin around the neurons[32] activated by the activity. This is called myelination, and as discussed is what causes information to flow between neurones efficiently. It has been found that when focusing intensely on subject matter, perhaps in a state of deep work, this level of myelination will increase[33]. As a result, there will be a greater amount of myelin around the axon of those neurones, providing better insulation and therefore a more efficient flow of information from one neurone to another. As stated in a 2022 report by Asana, a prominent neuro-company based in San Francisco, that means when you focus intensely on a specific skill, 'you are rewiring your brain to help you perform that skill more effectively'[34]. This increases the understanding of the skill being learnt and means that it will be memorised to a far greater degree in the short-term and long-term. This is how professors at research universities, and my previous example Jason Benn, are able to learn vast amounts of information in such short spaces of time. Due to the fact that they are isolating the neurones within their brain, and solely focusing on that specific topic for a set amount of time, they are able to increase the myelination of their neural pathways, and consequently will be able to retain a far greater amount of the information which they are receiving. By isolating the mind's focus, we can in turn isolate a select few neurones for an extended period. This is what leads to greater myelination.

On the other hand, by being distracted and engaging in multiple activities whilst working, this same degree of myelination cannot occur. Many different areas of the brain will be 'lit up', meaning that attention is shared between many things, and due to the fact that there are a limited number of ogidendroytes within the brain, this means that only a limited amount of myelination can occur at each neurone[35]. The attention is spread too thin. Therefore, by attempting to work with multiple things on the mind's peripheral, the myelination which one area of neurones could have experienced is divided between all of the other distracting factors. As proven by researchers at the University of San Francisco, in a report investigating the effects of myelin on the long-term memory, this information retention 'depends on the brain's ability to rewire itself by forming connections between neurons', and this is a major determinant in whether new, hard-to-process information is retained[36].

As shown through the neuroscience of myelination and memory, practicing deep work has the capacity to increase myelination of neural pathways to a far greater degree than working in a distracted manner. In turn, this has the capacity to increase information retention and both short-term and long-term memory of the information received. As a result, this will allow the user of deep work to master skills quickly and efficiently, whilst a person which is overstimulated to an excessive degree, with a decreased attention span, impulses to use technology and a distracting environment, will benefit far less from their working efforts.

The 'attention residue' effect

Whilst it may appear that a person who is overstimulated could momentarily ignore their devices and addiction to dopamine, to do a solid hour of deep work in an undistracted environment to the same capacity as someone which isn't

overstimulated, this is not the case. This is due to the idea of attention residue, which suggests that when you switch from one task to another, your attention does not immediately follow, and a residue of your attention will remain focused on the previous task[37]. Resultantly, if someone has been watching videos on TikTok, a prominent and widely used social media app, for the previous hour then their mind will be processing information of multiple different sources, and simply will not be able fall into a state of deep focus. Scientifically speaking, it is because each morsel of information consumed prior has activated different neurones within the brain, and consequently the oligodendrocytes are stretched between tasks. By attempting to focus on a task immediately after, any myelination which would have occurred is severely diluted, as the neurones are not solely isolated. This means that there will be less insulation along the desired neural pathways, and in turn the worker will have more difficulty understanding the task at hand, and that any new information will have a far lower retention rate.

The impact of overstimulation on productivity

Whilst it has been established that overstimulation of the senses can lead to an increased addiction to the dopamine released by the use of technology, and that this can lead to a negative cycle of lowered attention which causes people's subconscious reliance on technology to increase dramatically, the effect of this overstimulation on one's productivity must now be considered. Thus, I will be dividing this section into two parts: the effect of overstimulation on the quality of work produced, and the quantity of work produced. It is my understanding that this will make the argument most understandable, and perhaps shocking.

Impact on the quality of work produced

If a person is overstimulated at the time of working, or has been overstimulated prior to their work, then they will produce a far lower quality of work. This is due to the fact that they are likely to become distracted whilst attempting to work, which will interrupt thought flow and discourage deep focus on the task at hand. By being in a state of semi-concentration, the mind may drift away from the topic at hand, meaning the best work is not being done. As a result, critical thought becomes more difficult for the worker, as they are subconsciously considering other things. Concentration on a task can be disrupted by any other source of information entering the brain: this was proven by Nick Perham and Harriet Currie of Cardiff Metropolitan University in 2019. In their research-report, it was detailed that students who revised in "quiet environments performed more than 60% better in an exam than their peers who revised while listening to music"[38], and that this could be acclaimed to the reduced distractions which the people working in quiet environments experienced, unlike those which listened to music and were subconsciously processing the rhythm of the song concurrently. Perham and Currie also found that students which listened to music "without lyrics did better than those who had revised to music with lyrics"[39]. This further extends their findings, as introducing words which needed to be processed, alongside the work and rhythm of the song, added another medium of distraction which inevitably decreased revision-focus further. In the workplace, it has been shown that the average employee is interrupted 50 to 60 times per day[40], with roughly 80% of these interruptions being unimportant. In addition, office workers will receive constant streams of emails throughout the day, and are expected to provide an almost immediate response. The effect of this is that workers are unable to reach a state of deep work, due to constant distraction, and consequently will spend most of their day in a state of semi-concentration, due to the overstimulating environment which they are working in. This is true for all people too: if a person is overstimulated, and feels the urge to use their phone impulsively throughout the day, then this will be a distraction when attempting to work deeply, whether they choose to engage with their phone or not. By being unable to reach a state of deeper concentration, and constantly having their mind pulled away from the task, it is impossible to complete the task to its full extent, as less extensive thought has been given to it. Therefore, technological overstimulation has the capacity to reduce the quality of work produced.

Impact on the quantity of work produced

One of the effects of overstimulation is that which it has on the dopamine cycle. As discussed, excesses of information coming into the brain can prove exciting and stimulating. In turn, the brain will release dopamine as a reward, making the

person feel happy and encouraging them to repeat this action. However, when dopamine comes from an easily accessible source, such as phones or televisions, then this can become addictive for certain people and discourage them from using their time effectively. As seen in the famous research study by James Olds and Peter Milner, when rats were provided with pleasure 'on tap', they would eventually stop all basic functions, even eating and caring for their new-born pups. Less extreme parallels can be drawn between these rats and humans too: technological stimulants provide a very similar medium of pleasure. An example of this is the social media app, TikTok. TikTok is a powerful invention: because videos are usually between 21 and 34 seconds in length[41], this means that an average user will scroll through multiple videos in a short space of time. As a result, the brain receives a barrage of information, which it finds stimulating and receives dopamine for. This can make it highly addictive. In a research paper by HMWM Herath of the University of Sri Lanka, it was found that nearly 30% of students there are addicted to TikTok and just over 87% of students will spend at least two hours per day on social media[42]. In this research-report, 240 students at the researcher's campus took part in a structured questionnaire about their social media usage, which showed that 208 of the 240 students choose to spend two hours or more on social media, rather than getting ahead in their classes. A good summary of the ideas discussed comes from Jasmine Cundiff of Epigram, who writes: "the sight of comic sans in a word document is boring in comparison, and it is often difficult to transition from the stimulating content within social media to the black and white pages of a textbook"[43]. By analysing the result of this report, it becomes clear that severe cases of overstimulation, and consequent dopamine addiction, have the capacity to impact people's actions. As a result, some students may neglect work at times - instead choosing to use technology as they believe it will be more pleasurable. Whilst working hard releases dopamine, this is an action which requires far greater effort and can seem less rewarding. As a result, students and workers alike may choose to neglect spending their time working, in favour of technology's easy stimuli. Therefore, technological overstimulation has the capacity to reduce the quantity of work produced.

Conclusion

After taking into account the research and source-matter which I have collated and used within this essay, it is clear that there is subsequent evidence to conclude that over-stimulation affects productivity negatively to a proportionate extent. The prominence of technology within society means that the mental effects of its usage are unavoidable, and when people become overstimulated it is clear that this technology this can undoubtedly cause them to form addictive tendencies towards devices.

By becoming over-stimulated and giving in to urges to use technological devices, especially mobile phones and social media platforms, a person's productive capacity will inevitably decrease as a result of their lower ability to retain newly learnt information, and there will be a commensurate decline in the quality and quantity of their productive output. This is due to a preference for a technological interface over tasks which require greater effort meaning that productivity, defined as one's effective productive effort, must surely decrease when considering their overall work output. Whilst technology usage can be moderated and rationed to the point that a person does not become overstimulated, it is clear that there is a certain threshold of technology usage at which a person will invariably become overstimulated; past this point, there is clear evidence to show that overstimulation, dependent on its degree, will lead to varied decreases in productivity, with the most extreme forms of overstimulation leading to the most significant decreases in productivity, and vice versa.

Acknowledgements

It is important that I thank my supervisor, M Schofield, for his guidance and help with formatting this document.

Index Number	Date Accessed	Source	Origin	Credibility	Overall judgement
1	12/10/22	https://dictionary.cambridge.org/dictionary/english/stimulation	Cambridge Dictionary	This source is highly credible as it comes from one of the most highly renowned Dictionary producers and will have been edited extensively to remove inaccuracies.	This source is valid and useful as it outlines the meaning of a key variable of my essay.
2	12/10/22	https://www.health.harvard.edu/mind-and-mood/6-simple-steps-to-keep-your-mind-sharp-at-any-age	Harvard University Medical School	Highly credible as it comes from a prestigious and well-funded university, which is renowned for its academic prowess.	This source is valid and useful as it outlines the meaning of a key variable of my essay.
3	12/10/22	https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100348129	Oxford Dictionary	Highly reliable as it comes from another of the largest dictionaries, therefore is likely to be accurate.	This is valid and will support my essay greatly.
4	12/10/22	https://languages.oup.com/google-dictionary-en/	Oxford Dictionary	Highly reliable as it comes from another of the largest dictionaries, therefore is likely to be accurate.	This is valid and will support my essay greatly.
5	14/10/22	https://www.sciencedirect.com/topics/psychology/overstimulation	Science Direct	A company which conducts research into varied scientific areas and is trusted by researchers as being a credible source.	This is valid, as it provides context to my work and comes from a credible source.
6	15/10/22	https://raisingchildren.net.au/newborns/behaviour/commoncon-cerns/overstimulation#:~:text=Overstimulation%20happens%20when%20children%20are,event%20like%20a%20birthday%20party.	Raising Children Australia	This report was written in late 2021, and therefore it is likely not outdated. Additionally, the information comes from a site which is highly trusted by parents (particularly in Australia), and is therefore likely to be reporting correct information.	Whilst this comes from a source based predominantly in Australia, and not the whole world, this is a valid source as it writes based off of evidence, and therefore has reasoning behind its arguments.
7	15/10/22	https://www.bankmycell.com/blog/average-screen-time-on-iphone-	Bank My Cell – written by Ashley Turner	This comes from a source which focuses research solely on technological subjects, particularly smartphone usage. It has been published in reports by Forbes and PBS, and therefore is highly credible.	This is valid as the statistics presented by the website have been found through investigation and testing and they come from a credible source.

Index Number	Date Accessed	Source	Origin	Credibility	Overall judgement
		android -:~:text=Average%20Screen%20Time%20(iPhone%20and,Users%20Aged%2016%20to%2064)&text=The%20data%20from%20DataReportal%20reports,49%2Dminute%20increase%20since%202013.			
8	05/11/22	https://explodingtopics.com/blog/screen-time-stats	Exploding Topics – written by Josh Howarth	This source is extremely relevant as it was released on the 13th January, 2023. The website used focuses on statistics across the board, and is likely therefore to be unbiased. However, as they do not specialise in tech-info, their stats may not be 100% accurate.	I view this source as being valid, as it comes from a statistic company and will be reflective of the population. It is important as it provides required oversight.
9	10/11/22	https://blog.bitsandpieces.com/overstimulation-survey	Bits and Pieces Blog	Written in March 2022, this report is based of statistics taken within the USA. As the findings are verifiable by research, and this is a relatively new report, I deem this source as credible.	I will use this source, as I deem it credible and find that its findings are highly useful to my essay.
10	10/11/22	https://www.statefarm.com/simple-insights/family/effects-of-cell-phones	State Farm	This is a certainly credible source as it comes from State Farm, one of the largest life insurance providers in the USA, and is a highly-funded company. Therefore, it is likely to be critical and accurate in what it publishes.	This source and piece of evidence is certainly valid and is highly valuable to my EPQ, as it creates the basis of my research report.
11	10/11/22	https://my.clevelandclinic.org/health/articles/22513-neurotransmitters#:~:text=Dopamine.,%2C%20sleep%2C%20mood%20and%20motivation	Cleveland Clinic	Likely to be reliable as this is a large organisation which offers advice and action to those which fall victim to excessive social media use, whilst overall being a prominent healthcare firm. However, may be slightly biased as notion of company is to discourage too much emotional investment in social media, as this is where some bullying occurs.	I view this source as valid as it comes from a reputable organisation which uses such facts for the greater good of the USA. This is required to give proof and support my opening sources.
12	15/11/22	https://www.webmd.com/mental-health/what-is-dopamine	Web MD – written by Hope Cristol	This source comes from a company which offers advice to people over social media usage, and supports it with scientific findings.	I view this source to be valid. It comes from a credible source, and is crucial to my argument as it describes simply what Dopamine is.

Index Number	Date Accessed	Source	Origin	Credibility	Overall judgement
13	15/11/22	https://www.healthdirect.gov.au/dopamine#:~:text=of%20the%20brain.-,What%20is%20the%20role%20of%20dopamine%3F,of%20dopamine%20in%20the%20brain.	Health Direct Australia.Gov	This source must be trusted as credible as it has been produced by the government of a highly economically developed nation, which is well-informed by some of the top scientists in the world. It is recent, being from 2021.	Due to the nature of this source, it must be trusted and is therefore valid. It is important to my written essay as it helps me to outline the role of Dopamine within the brain.
14	15/11/22	https://www.webmd.com/mental-health/what-is-dopamine	Web MD – written by Hope Cristol	This source comes from a company which offers advice to people over social media usage, and supports it with scientific findings.	I view this source to be valid. It comes from a credible source, and is crucial to my argument as it furthers my explanation of Dopamine's effects.
15	18/11/22	https://www.sciencedaily.com/releases/2008/07/080708173226.htm#:~:text=Summary%3A,promote%20negative%20feelings%20like%20fear.	Science Daily – written by key editor	Whilst this source is from 2009, the content which I have referenced is entirely theoretical and is therefore unlikely to have changed/been disproven since.	This is valid and important, as it should how the chemical Dopamine may be viewed in a different light to how it is currently perceived.
16	19/11/22	https://www.dailymail.co.uk/science-tech/article-2449632/How-check-phone-The-average-person-does-110-times-DAY-6-seconds-evening.html	The Daily Mail – written by Victoria Woollaston	This source comes from a highly renowned news company based in the UK. Whilst they may have a political bias, the information cited is solely investigational, and therefore unlikely to be affected.	This source is valid, given that the investigations conducted were valid, and therefore can be trusted and is important, as it provides evidence for an increase in technology use.
17	21/01/23	https://www.huffpost.com/entry/compass-pleasure_b_890342	Huffington Post – written by David J. Linden	Very reliable source as coming from a multinational news company. Webpage has been active since 2011, and therefore the report will have been cleansed of any inaccuracies. In addition, there are no statistics included: only the account of James Olds' experimentation on rats.	I regard this as highly valid, as there is no cause for possible bias and little scope for inaccuracies in such a well-known story.
18	17/12/22	"Positive reinforcement produced by	Research report by James Olds and Peter	The two accredited researchers are world-renowned for their famous experimentation and findings together. Their work has been cited	This is a highly valid and useful piece of evidence, as it has been well-produced and gives a brilliant example of

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		electrical stimulation of septal area and other regions of rat brain". Produced in 1954.	Milner of McGill University.	countless times since it was published, and they conducted it at one of the top facilities in the world. It is reliable.	the effect of Dopamine (excess) on the brain.
19	21/01/23	https://www.adweek.com/performance-marketing/attention-spans-have-dropped-from-12-minutes-to-5-seconds-how-social-media-is-ruining-our-minds-info-graphic/	Adweek – written by Neil Vidyarthi	This was a paid article which I decided to buy. The statistics quoted were found through Adweek's own research, and have been scrutinised by the article writer. Therefore, I believe they are reliable.	The statistics taken from this article are valid and provide proof to the idea that there is a mass decrease in attention spans overall.
20	23/01/23	https://www.kcl.ac.uk/news/are-attention-spans-really-collapsing-data-shows-uk-public-are-worried-but-also-see-benefits-from-	King's College, London – written collaboratively by students	This is a reliable source as it is compiled by a highly reputable research university. Therefore, some of the brightest minds in the country will have worked on this report, and it will have had large funding. It is unlikely that there will be bias here.	This source is reliable and likely to be free of bias. It is very important to my piece of work as it highlights the subsequent effect of overstimulation on our actions.
21	23/01/23	https://qz.com/1103166/american-kids-daily-mobile-screen-time-is-almost-10-times-higher-than-it-was-in-2011	Quartz Media	Reliable source, as the story is based off observed statistics. However, this is a report conducted by a company from the U.S.A on children from the U.S.A. There also may be a political bias to this, as many media companies within the US will be politically slanted.	This report will be useful and reliable for my essay, provided that I make it clear that it is referring to children from the U.S.A, not the UK
22	08/01/23	https://www.kcl.ac.uk/news/are-attention-spans-really-collapsing-data-shows-uk-public-are-worried-but-also-see-benefits-from-technology#:~:text=It%20is%20the%20case%20t	Report by King's College London	This is a reliable source as it is compiled by a highly reputable research university. Therefore, some of the brightest minds in the country will have worked on this report, and it will have had large funding. It is unlikely that there will be bias here.	This source is reliable and likely to be free of bias. It is very important to my piece of work as it highlights the subsequent effect of overstimulation on our actions.

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		hat,with%20our%20ability%20to%20concentrate.&text=For%20example%2C%20switching%20our%20attention,by%2067%25%20of%20the%20public			
23	23/01/23	"Deep Work". Released January 2016.	Extract from the book by Cal Newport	Cal Newport's book was released in 2016, meaning that the science is still current, and Cal Newport is an expert in his specific field. Therefore, I deem this source as very reliable.	This source is valid, as the information comes from a prominent author, and the book is in the public domain and open to scrutiny, if there were any inaccuracies.
24	20/11/22	https://en.wikipedia.org/wiki/Bollingen_Tower	Wikipedia – ownership of Bollingen Tower photograph	Completely reliable, unless this image was doctored in any way. This would be highly unlikely.	This image is very useful as it provides context/illustrates the point I attempt to make.
25	10/01/23	https://www.britannica.com/biography/Carl-Jung	Britannica	Likely to be highly reliable as this source only relays some of his well-documented achievements.	This source is important as it gives credit and status to Jung's work.
26	23/01/23	"Deep Work". Released January 2016.	Extract from the work by Cal Newport	This source is likely to be unbiased as it relays factual information about how Jung would work. It will be thorough and accurate as it is from a published book by a highly acclaimed author.	This source is reliable and provides valuable information to my piece which shows the benefits of high concentration work.
27	23/01/23	*https://en.wikipedia.org/wiki/Carl_Jung_publications*	Wikipedia – Carl Jung's bibliography	This source is likely to be accurate as it only relays the factual publications of Jung, and is presented by a highly funded and renowned organisation.	This source is important as it documents the work which Jung was able to complete this way.
28	23/01/23	"Deep Work". Released January 2016.	Extract from the book by Cal Newport	Cal Newport's book was released in 2016, meaning that the science is still current, and Cal Newport is an expert in his specific field. Therefore, I deem this source as very reliable.	This source is valid, as the information comes from a prominent author, and the book is in the public domain and open to scrutiny, if there were any inaccuracies, which could be revised.
29	23/01/23	"Deep Work". Released January 2016.	Extract from the book by Cal Newport	Cal Newport's book was released in 2016, meaning that the science is still current, and Cal Newport is an expert in his specific field. Therefore, I deem this source as very reliable.	This source is valid, as the information comes from a prominent author, and the book is in the public domain and open to scrutiny, if there were any inaccuracies, which could be revised.
30	23/01/23	"Deep Work". Released January 2016.	Extract from the book by Cal Newport	Cal Newport's book was released in 2016, meaning that the science is still current, and Cal Newport is an expert in his specific field. Therefore, I deem this source as very reliable.	This source is valid, as the information comes from a prominent author, and the book is in the public domain and open to scrutiny, if there were any inaccuracies, which could be revised.

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31	24/01/23	https://asana.com/resources/what-is-deep-work	Asana – written by Caeleigh MacNeil	Asana is a productivity website and produced many articles yearly. There are likely reliable, due to their large teams of researchers and good funding.	This source is valid, and is important as it illustrates exactly what deep work is.
32	24/01/23	https://www.mayankja.in/blog/notes-from-deep-work-rules-for-focused-success-in-distracted-world	Mayankja – extract written by Mayank Jain	The writer of this article, Mayank Jain, is a prolific intellectual which sells advice to people on how they can better their lives. Whilst there is scope for bias here, by potentially aiming to attract customers, this source is reliable as I solely use the scientific research, not Jain's own opinions.	This source is valid, as it references contemporary neuroscience bases and therefore has little scope for bias or inaccuracies.
33	24/01/23	https://www.mayankja.in/blog/notes-from-deep-work-rules-for-focused-success-in-distracted-world	Mayankja – extract written by Mayank Jain	The writer of this article, Mayank Jain, is a prolific intellectual which sells advice to people on how they can better their lives. Whilst there is scope for bias here, by potentially aiming to attract customers, this source is reliable as I solely use the scientific research, not Jain's own opinions.	This source is valid, as it references contemporary neuroscience bases and therefore has little scope for bias or inaccuracies.
34	24/01/23	https://asana.com/resources/what-is-deep-work	Asana – written by Caeleigh MacNeil	Asana is a productivity website and produced many articles yearly. There are likely reliable, due to their large teams of researchers and good funding.	This source is valid, and is important as it illustrates exactly what deep work is.
35	24/01/23	https://www.mayankja.in/blog/notes-from-deep-work-rules-for-focused-success-in-distracted-world	Mayankja – extract written by Mayank Jain	The writer of this article, Mayank Jain, is a prolific intellectual which sells advice to people on how they can better their lives. Whilst there is scope for bias here, by potentially aiming to attract customers, this source is reliable as I solely use the scientific research, not Jain's own opinions.	This source is valid, as it references contemporary neuroscience bases and therefore has little scope for bias or inaccuracies.
36	12/01/23	https://psychiatry.ucsf.edu/news/study-adds-evidence-overlooked-role-myelin-long-term-memory-storage	Research report from Weill Institute of Neurosciences, UCSF – written by Pete Farley	This source is likely highly reliable, as these findings have come from an institute at a well-funded university which researches neuroscience extensively. Therefore, investigation is likely highly accurate and the results taken are valid.	This source is valid, as it has little scope for bias and is likely to be scientifically accurate due to the fact that it comes from a specifically-neuroscience-based institute at one of the world's top universities.
37	24/01/23	https://www.mayankja.in/blog/notes-from-deep-work-rules-for-focused-success-in-distracted-world	Mayankja – extract written by Mayank Jain	The writer of this article, Mayank Jain, is a prolific intellectual which sells advice to people on how they can better their lives. Whilst there is scope for bias here, by potentially aiming to attract customers, this source is reliable as I solely use the scientific research, not Jain's own opinions.	This source is valid, as it references contemporary neuroscience bases and therefore has little scope for bias or inaccuracies.

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38	07/02/23	https://www.theguardian.com/teacher-network/2018/mar/14/sound-how-listening-music-hinders-learning-lessons-research	The Guardian – written by Bradley Busch	This source is likely to be reliable as it is based off a study conducted by the Guardian, however there are opinions of the writer interwoven. I trust this source, as there is little room for bias in this report and it is highly factual. The Guardian is a highly prominent, well-funded organisation. Therefore their studies are likely to be accurate.	I take this report to be reliable, due to the fact is comes from a highly reputable source. It is important as it highlights the neurological effects of distraction on productivity.
39	07/02/23	https://www.theguardian.com/teacher-network/2018/mar/14/sound-how-listening-music-hinders-learning-lessons-research	The Guardian – written by Bradley Busch	Whilst newspapers may be politicised in their views, I view this source to be reliable as it is merely relaying statistics about investigational findings.	This source is likely to be as valid as possible, as it would be hard to implement bias into statistical findings, and these findings are likely to be accurate if conducted by such a large company with great funding.
40	09/01/23	https://hbr.org/2019/12/10-quick-tips-for-avoiding-distractions-at-work	Harvard Business Review – written by Steve Glaveski	I would expect this source to be very trustworthy given the prestige of the Harvard institution. There will have been a large budget for this report and it will have been expected to be completed to the highest echelon.	This will be highly beneficial as it provides key evidence for distraction within the workplace, naming examples additionally.
41	10/01/23	https://sociality.io/blog/tiktok-video-length/	Sociality.io – written by Adedoyin Jesutofunmi	These statistics on TikTok video length were accurate in June 2022, and therefore could be outdated. However, I could not find any other source to disprove this, and the notion of this source is enough to convey my argument.	I view this source as valid, as the report was compiled well and is unlikely to be biased. Regardless of exact length, these statistics illustrate the effect of TikTok videos on the mind.
42	09/01/23	https://www.theajhssr.com/V-3_6/THEAJHSSR_T03601410146.pdf	Dissertation by HMWM Herath of UvaWellassa University of Sri Lanka	This would be expected to be completed to a high standard due to the fact that it is a student's important research piece. However, it appears terse at times and may be lacking in accuracy, given that it was compiled by a relatively inexperienced student.	I place value on this source due to its statistics, however understand that this may not be the most accurate/scientific evidence to use.
43	24/01/23	*https://epigram.org.uk/2021/03/17/is-technology-causing-our-attention-span-to-shrink/*	Epigram – Newspaper of Bristol University. Written by J. Cundiff.	Very relevant as released in early 2021. Written by a university student for the university newspaper, however does not appear to be biased as the writer writes factually without inputting her personal opinion.	This source is very useful as it provides a great summary of the points I have conveyed within my essay, with respect to how the will to work decreases when overstimulated.