



Understanding Excessive Use of Social Media

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Introduction

Social media is a collection of technologies that allows people to create virtual networks of contacts, share text, video and images with these contacts, and view and respond to contacts' posts (Boyd & Ellison, 2007). YouTube, Instagram, Snapchat and Facebook are the most prevalent social media sites among US teens, with corresponding penetration rates of 85%, 72%, 69% and 51% (Pew Research Center, 2018). The increased prevalence of smartphone devices has afforded the anytime, anywhere use of social media sites. Indeed, ninety-five percent of teens have smartphones and 45% admit that they are almost constantly connected (Pew Research Center, 2018). The use of such sites is also largely unregulated and hence teenagers start using social media at a young age; half of 12-year-olds already have some social media presence (Common Sense Media, 2016). Even though social media sites enforce age limits (e.g., 13 years old is the minimum age to use Facebook), these restrictions are easy to bypass with simple untruthful reporting of one's birth year. In addition, in recent years social media providers started targeting the young audience (e.g., 6 years old and up in the case of Facebook's Messenger Kids) presumably in an attempt to capture audiences early on in life, before they can make more informed decisions (Metz, 2018).

Importantly, social media sites can act as a double-edged sword; they often present a duality of positive and negative consequences for users (Serenko & Turel, 2015; Turel & Serenko, 2012; Turel, Serenko, & Giles, 2011). This duality is supported in many studies that have demonstrated that social media use can be beneficial for some users (e.g., older or socially isolated populations) or in some situations (e.g., when used actively, as opposed to passively), but also be harmful for others (e.g., children, cyber-bullied individuals) or in different situations (e.g., when used while driving, or excessively). To illustrate this duality, I note that in a recent large survey 31% of teens reported perceiving social media impacts on them as mostly positive, 24% as mostly negative, and 45% were ambivalent regarding social media effects, as they saw both positive and negative effects of social media on them (Pew Research Center, 2018).

Possible Positive Effects of Social Media Use on Users

Positive effects of social media use often accrue at low-medium (as opposed to high or excessive) levels of social

media use, at which level people typically do not have major decision making deficits (Chen et al., 2018; Wei, Zhang, Turel, Bechara, & He, 2017). Moreover, at low-medium levels of social media use, it can displace other rewarding but dangerous activities such as substance use (Turel & Bechara, forthcoming). Such positive effects also accrue mostly when people are active on social media (i.e., post messages and share content) as opposed to being passive users (i.e., merely follow their peers) (Krasnova, Widjaja, Buxmann, Wenninger, & Benbasat, 2015).

The basic element of the positive effect of social media use on people is psychological rewards (Turel & Serenko, 2012). Indeed the use of such sites (Turel, He, Xue, Xiao, & Bechara, 2014) and specific activities such as observing "likes" (Meshi, Morawetz, & Heekeren, 2013; Meshi, Tamir, & Heekeren, 2015) can be associated with activation of mesolimbic dopamine circuits in the brain, which produce subjective feelings of euphoria and joy. Other, higher-order, example-positive effects include reduced loneliness, mostly among isolated and lonely people (Nowland, Necka, & Cacioppo, 2018), increased social capital (Ellison, Steinfield, & Lampe, 2007), ability to observe and learn from others (Osatuyi & Turel, 2018; Turel & Osatuyi, 2017), increased productivity in organizational and learning settings (Turel & Serenko, 2010), allowing people to collaborate online (Turel & Connelly, 2012; Turel & Zhang, 2010, 2011), displacing other risky and rewarding activities (Turel & Bechara, forthcoming), affording an augmented-controlled self-image that shelters people from who they truly are or their vulnerable-selves (Gil-Or, Levi-Belz, & Turel, 2015), and allowing people to cope with boredom and share positive affect situations (Turel & Bechara, 2016b).

There is also emerging evidence that healthy (low-medium levels of) use of social media can be associated with brain changes that may be beneficial for individuals. For example, we show in a sample of 33 social media users that the level of social media use is associated with increased grey matter volumes in brain regions involved in social-semantic and mentalizing tasks (specifically, the posterior parts of the bilateral middle and superior temporal, and left fusiform gyri), such as assigning semantic meaning to faces and interpreting social cues in social interactions (Turel, He, Brevers, & Bechara, 2018b). If the use of social media causes such brain morphology adaptations (as opposed to being merely associated with or caused by such inter-individual brain differences; yet to be proved), then social media use can help populations with social deficits to strengthen brain regions that support social interactions.

Possible Negative Effects of Social Media Use on Users

Negative effects of social media use on users can accrue at any level of social media use, but they are more pronounced

at very high levels of use. Such negative effects stem from problematic or deviant behaviors, defined as a family of behaviors that can harm the self or others and which are largely socially disapproved. Examples of such behaviors include cyberbullying (Turel & Qahri-Saremi, 2018a), swearing on social media (Turel & Bechara, 2017; Turel & Qahri-Saremi, 2018a), using social media while driving (Turel & Bechara, 2016a), avoiding school work to engage in social media use (Qahri-Saremi & Turel, 2016; Turel & Qahri-Saremi, 2016; Turel & Qahri-Saremi, 2018b), and using social media excessively to a point where it interferes (significantly or not) with normal functioning (Turel & Bechara, 2016b; Turel, Mouttapa, & Donato, 2015; Turel, Poppa, & Gil-Or, 2018; Turel & Qahri-Saremi, 2016; Turel & Serenko, 2012; Turel, Serenko, & Bontis, 2011; Turel, Serenko, & Giles, 2011).

The negative outcomes of such behaviors can include emotional strain in the form of guilt, in response to the social disapproval of such problematic behaviors and their incongruence with one's expectations from themselves (Turel, 2015, 2016), increased stress (Turel, 2017; Turel & Gaudio, 2018), reduced school performance (Turel & Qahri-Saremi, 2016) and engagement (Qahri-Saremi & Turel, 2016), time perception distortion (Turel, Brevers, & Bechara, 2018), increased sedentary time, obesity and cardio-metabolic risks (Turel, Romashkin, & Morrison, 2016; Turel, Romashkin, & Morrison, 2017), reduced belief in one's ability to control their use and quit it (Osatuyi & Turel, 2018; Turel, 2015; Turel & Osatuyi, 2017), increased work-family conflict (Turel & Serenko, 2010); and ultimately, the development of addiction-like symptoms in relation to social media use (Turel & Qahri-Saremi, 2016; Turel & Serenko, 2012). Here, without discounting the importance of the many problematic behaviors and states that may be associated with social media use, I focus on excessive use of social media.

Excessive Use of Social Media

The excessiveness of social media use is not measured by use time, frequency or intensity, because what is excessive for one person may be normal, un-harmful and even beneficial for another. For example, five hours of social media use per day may benefit an isolated, lonely elderly person, but may be harmful for a middle-school student who needs to spend time studying, maintaining hobbies, exercising, or socializing face-to-face. Excessiveness may even change within-individual depending on the circumstances. For example, spending three hours a day on social media may not be excessive for a student on summer break who needs to pass time between social and sports activities, but it may be excessive during school time or exam periods.

As such, the excessiveness of social media use is typically captured by the persistent negative symptomology it produces (Turel et al., 2014; Turel, Serenko, & Giles, 2011). These symptoms resemble those observed in relation to more established addictions, and specifically behavioral addictions such as gambling; they include salience, withdrawal, relapse, tolerance, mood modification and conflict symptomology (Griffiths, Kuss, & Demetrovics, 2014) that is presented in relation to social media use (Serenko & Turel, 2015). The more addiction-like symptoms the use of social media is associated with, the more excessive this activity

becomes (Serenko, Turel, & Giles, 2009; Turel & Serenko, 2012; Turel, Serenko, & Giles, 2011). I accordingly define excessive use of social media (sometimes called "social media addiction" or "social networking site addiction") as a "state of maladaptive dependency on the [use of the social media site] that manifests in compulsively seeking and engaging in [social media site] use to such an extent that typical behavioral addiction symptoms emerge (e.g., withdrawal, salience, tolerance, mood modification, conflict, and repeated relapses)" (Turel, He, Brevers, & Bechara, 2018a, p. 694).

I note that describing such issues as an "addiction" as opposed to "excessive use" is not yet agreed upon and that clear criteria for classifying people as "addicted", "clinically impaired users" or "excessive users" are still lacking (Carbonell & Panova, 2017). Therefore, I use the term "excessive social media use" here, while noting that it parallels the myriad of terms (e.g., social media addiction) used in prior research. There are several proposed classification criteria for video-game disorder (van Rooij, Schoenmakers, Vermulst, van den Eijnden, & van de Mheen, 2011), including proposed criteria in DSM 5 (American Psychiatric Association, 2013). The situation is in more embryonic stages when it comes to excessive social media use, even though some criteria started emerging (Banyai et al., 2017). Using such preliminary classification criteria, it has been suggested that there is about a 4.5% prevalence rate of risk for excessive social media use in adolescents, but rates can reach 15.2% (Turel, Brevers, et al., 2018) and 17.8% (Tang, Chen, Yang, Chung, & Lee, 2016) in young adults. A large portion of the rest of the population of users also experiences at least some addiction-like symptoms, but they do not meet the commonly employed classification criteria (Turel, Brevers, et al., 2018). Hence, studying excessive use of social media, its drivers, outcomes and mitigation mechanisms is important and can pertain to large segments of the population.

Why People Use Social Media Excessively

Like other excessive and problematic behaviors (Chen et al., 2018; He, Huang, et al., 2018; Wei et al., 2017), excessive social media use is rooted in an imbalance between a hyper-active reward system, and relatively weak (or hypo-active) self-control or inhibition brain faculties (Turel et al., 2014; Turel & Qahri-Saremi, 2016; Turel & Qahri-Saremi, 2018b). This imbalance can be influenced by both nature and nurture (He, Turel, & Bechara, 2017; He, Turel, Brevers, & Bechara, 2017). A necessary condition for activating and accentuating this imbalance lies in the way social media sites are designed and the consequent reward variability they generate.

Like many other websites, social media sites need to fight for customer retention and increased time spent on their sites, as opposed to on competing sites. They do so by trying to reinforce social media use behavior through a variable reward schedule (Eyal & Hoover, 2014). Rewarding behaviors produce behavior-reward associations in people's brains, which leads to behavior seeking and reenactment (Sutton & Barto, 1998). This reinforcement is accentuated when rewards are obtained on a variable schedule (Ferster & Skinner, 1957). When reward schedule is variable, people can develop behavioral addictions and



substance abuse disorders (Clark & Limbrick-Oldfield, 2013; Everitt & Robbins, 2005) and engage in problem gambling (Sescousse, Barbalat, Domenech, & Dreher, 2013). Social media sites have mastered the provision of variable reward, for example through an unknown schedule of others' posts, "likes", and comments (Meshi et al., 2015). Hence, it is not surprising that some social media users behave in a similar way to the way Skinner's pigeons behaved in his famous experiments. They do not peck surfaces for food pellets; they instead peck (or click in their case) for "likes", new posts, and new self-enhancing and rewarding information, which too, appears in a variable schedule.

It is worth noting that children and youth are more vulnerable than many other populations to such excessive and often risky behaviors, given that they have a built-in imbalance between the reward and self-control systems. The reason for this imbalance is that these brain systems develop on different schedules (Casey, Getz, & Galvan, 2008; Giedd, 2004; Sowell, Thompson, Holmes, Jernigan, & Toga, 1999). While the reward system is fully developed during adolescent years, the self-control/ inhibition brain system matures later on; and the connectivity between left and right hemispheres (corpus callosum) which is needed for proper decision making matures even later (Casey et al., 2007; Casey, Giedd, & Thomas, 2000; Casey, Tottenham, Liston, & Durston, 2005; Durston et al.). This behooves researchers and system developers alike (and perhaps governments) to consider protections for children and youth.

The Neuroanatomical Roots of Excessive Social Media Use

In the Decision Neuroscience Lab of Dr. Antoine Bechara, we performed a series of studies aimed at unraveling similarities and differences between excessive use of social media and other behavioral and substance addictions. Multiple studies support such similarities, especially regarding functional hyperactivity (Turel et al., 2014) and structural pruning (reduced grey matter volume) of the reward (amygdala-striatal) system (He, Turel, & Bechara, 2017; He, Turel, Brevers, et al., 2017). We also observed similarities in interoceptive-awareness brain systems (insular cortex dependent) in that reduced volumes of the posterior insula were linked to addiction-like symptoms, as mediated via steeper delay discounting (Turel, He, et al., 2018a). While such studies did not reveal deficits in the brain systems that are involved in self-control (prefrontal cortex dependent), we found in another study some deficits in inter-hemispheric connectivity (white matter integrity) that can reduce self-control abilities in excessive users (He, Turel, & Bechara, 2018). Together, these findings show that the imbalance between reward and self-control systems is primarily a function of the hyper-sensitive (functionally and structurally) reward system; this is similar to less harming behaviors such as light smoking and moderate gambling. This is good news for people who try to treat or overcome excessive social media use—most of them can do it if they have sufficient motivation to do so; techniques such as mediation and cognitive behavioral therapy may help (He, Turel, & Bechara, 2017; He, Turel, et al., 2018; He, Turel, Brevers, et al., 2017).

Conclusions

Social media sites are here to stay. Like food, their consumption or use is almost a necessity. However, overconsumption or over-use can be harmful. We hence need to further study the behavioral and brain mechanisms associated with excessive use; and put emphasis on vulnerable populations, such as children and youth. We ultimately need to learn to live responsibly with such technologies.

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