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The role of stress and cognitive absorption in predicting social network addiction

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Abstract: Nowadays, the usage of social networks (SNs) is pervasive and ubiquitous. Among other things, SNs have become a key resource for establishing and maintaining personal relationships, as further demonstrated by the pandemic emergency. However, easy access to SNs may be a source of addictive behaviour, especially among the youngest. The literature highlights various psychological and physiological factors as possible predictors of vulnerability to SN addiction. This paper explores the joint effects of stress level and cognitive absorption, in the form of temporal dissociation while on SNs, on the addiction of university students to SN. 312 participants were involved in an online survey. About 14% of the sample presents a risk for SN addiction. Moreover, it is found that stress level predicts SN addiction both directly and indirectly through the effect of individual temporal dissociation as experienced during SN usage. These results suggest a significant role of perceived stress level on addiction risk, while also pointing out an additional vulnerability to SN addiction for those cognitive profiles that are relatively more prone to temporally dissociation while online.

Keywords: social network addiction; stress; cognitive absorption; temporal dissociation; Internet addiction

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1. Introduction

The introduction of social media such as Facebook, Instagram, Twitter, and so on, has brought about dramatic changes in interpersonal communication and relationships [1]. With the exponential increase of the number of active social media users [2], there has been a parallel reduction of engagement in other forms of communication such as phone calls, email correspondence, and face-to-face interaction [3], as well as of use of older legacy media such as books, TV, and movies [4]. Social networks are web-based services that enable the pursuit of several different goals, including, among others: building one's public or semi-public persona in the digital space; defining a personal network of relations with varying degrees of (e-)proximity; and gaining insight and access into the personal

networks of others [5]. In view of the well-known hyper-sociality of human beings [6], social networks and (online) social presence have unsurprisingly become a central sphere of activity in the life of many individuals. SNs may be sometimes associated with beneficial effects on human relations, as in the case of people with poor face-to-face sociability [7]. The potential benefits of SNs have become even clearer during the COVID-19 pandemic, in which social distancing has caused digital relationships to become at times the only viable option [8]. Even now that restrictions are being gradually lifted despite that the pandemic emergency is not over yet, the digital sphere of relations still maintains a key relevance, as people's interaction modes and habits have permanently adjusted to the new status quo [9]. On the other hand, the pervasive presence of, and ease of access to, social media, and the strong social incentives to take part in online conversations, which cater increasingly well understood biological, cognitive and social rewards [10], pave the way to possibly dysfunctional and even addictive practices of social media use in the general population and particularly among the youngest [11]. As the business model of social media calls for encouraging users to stay online as long as possible by fuelling a constant sense of anticipation of forthcoming rewards [12], addictive behaviours are generally not purposefully prevented by the interaction design of digital platforms, and are possibly even encouraged by features such as the dynamic scrolling of content [13] and push notifications [14], not to mention the possibility of favouring further substance addictions in turn [15]. However, a comprehensive theoretical understanding of the processes through which SN usage leads to addiction is still lacking [16].

It is still an open point whether such new forms of addiction should be included in the DSM-5 [17], which currently refers to them as a "condition for further study". There is however evidence suggesting that the psychological processes of people affected by internet/social network addictions are characterized by, among others, increased salience of the addictive activity, mood modification, craving, withdrawal and functional impairment – all of which are common criteria that jointly define substance abuse disorders [18]. Subjects with internet/social network-related addictive behaviours develop specific forms of anxiety, feel stressed by deprivation, and fail to successfully control their access time, but also integrate online activities in their coping strategies to manage negative affect, to secure buffering rewards, and to exploit them as an excuse for procrastination of other less pleasant activities [19-21]. Almost inevitably, a major consequence of the COVID-19 pandemic has been that of further exacerbating such practices in addicted subjects, and of spreading them further across the population [22,23], with an overall increase in the incidence of related addictive behaviours [24]. The social relevance of the phenomenon and its potentially dysfunctional impact on human conduct [25] have led to its flagging as a public health issue of serious concern [26]. Significantly, in a large-scale dataset a weak association has been found between all-purpose digital technology use and adolescent well-being [27]. However, a series of variables, such as gender, age, personality traits and specific clinical conditions, among others, are also likely to play an important role in the prediction of excessive use and susceptibility to addiction [28].

In particular, the role of stress appears of special importance. For example, Feng et al. reported that social anxiety partially mediates the impact of stress on internet addiction in adolescents [29]. Similarly, Jun & Choi, analysing data on stress in educational environments, concluded that adolescents who endure scholastic stress, especially when accompanied by negative affect, may be at higher risk of internet addiction [30]. Analogous results have been reported by Brailovskaia et al. who highlighted that daily stress is positively linked to propensities towards specific SN addictions (especially Facebook) [31].

Based on this evidence, and in view of the concomitant increase in the stress levels recorded in the population since the beginning of the pandemic emergency [32], a first aim of the current work has been to assess the direct influence of perceived stress during the pandemic on participants' addiction to SNs. We therefore hypothesized that perceived stress level positively predicts addiction level.

Nonetheless, recent literature on the impact of the COVID-19 pandemic on cognitive processing pointed out that prolonged experience of lockdown and, more generally, major changes in everyday habits cause a distortion of subjective time perception [33, 34]. For example, it has been reported that a slower subjective perception of passage of time is associated with increased levels of stress among the UK population [33]. Also, in a longitudinal study on French population, Droiet-Volet et al. reported that the improvement in dynamic perception of subjective experience (in terms of faster-paced time flow, countering the annoyance of excessively slow perceived passage of time) during the confinement period was related to a decrease in the level of boredom as the lockdown progressed [34]. Furthermore, as time spent on SNs is one of the key markers of the severity of addiction [35], we wonder whether perceived stress level impacts temporal dissociation while on SNs (by exacerbating the annoying perception of too slow passage of time), thus playing a role in the relationship between stress and SNs addiction. We therefore hypothesized that temporal dissociation during SN usage, as an indicator of longer time spent on SNs, would positively predict addiction level.

When considering existing evidence on the relationship between stress and dissociative processes, if the individual perceives high level of stress, dissociation may work as a coping strategy to mitigate this perception. This idea is supported by findings investigating different kinds of stressful experiences (e.g. early life stress [36]; daily stress [37]). On the other hand, in agreement with earlier literature on addiction (e.g. [38,39]), an increasing amount of evidence suggests that the higher the stress level, the higher the susceptibility to addiction. Moreover, as time spent is the key marker to predict internet/social network addiction (e.g. [40]) and as higher temporal dissociation may be conducive to underestimating the amount of time spent online, we expect that this may result in temporal dissociation level to positively predict addiction level.

To flesh out in some more detail the construct of temporal dissociation and the related time distortion, we refer to the construct of cognitive absorption, defined as a state of deep involvement with online experience [41]. A number of studies find that cognitive absorption is positively associated with internet addiction/problematic use [42,43]. This is the case even more for social networks addiction [44]. According to the cognitive absorption model proposed by Agarwal and Karahanna, cognitive absorption is described by five dimensions: focused immersion, engagement, control, curiosity, and temporal dissociation [41]. The latter factor is defined as the "inability to register the passage of time while being engaged in the interaction with a device" [41]. While, from a functional point of view, cognitive absorption has been mainly studied as related to different domains, such as, for example, technology acceptance or e-learning environments [45,46], little evidence is available about the role of cognitive absorption in digital addiction. As to temporal dissociation and problematic technology use, a significant time distortion during the use of smartphone has been found by comparing actual and estimated usage time as declared by participants, with a larger distortion reported by participants who spend more time with their smartphone [47]. To the best of our knowledge, there is just another paper that studies the impact of cognitive absorption on both smartphone and SN addiction [44]. However, no results are available so far about the role of cognitive absorption, and specifically of temporal dissociation, as a third intervening variable influencing the relationship between perceived stress and SN addiction. Therefore, a second aim of the current work is to evaluate whether different levels of temporal dissociation while on SNs brings about a different impact of perceived stress on SN addiction.

2. Materials and Methods

Participants

A sample of 312 voluntary participants (Male = 30.5%; Mean age: 20.9 ± 2.7 SD) was recruited through public announcement at college classes. Participants were recruited

from undergraduate programs across different majors. The recruitment call specified that only active social media users could take part in the study.

Procedure

The research complies with the Declaration of Helsinki and received approval from the appropriate Ethics Committee (Local Ethics Committee Regione Abruzzo ASL 1 Protocol #0008934/20, 14/01/2020 int 271). Participants, after providing their informed consent, completed an online survey and received no monetary or credit compensation for their participation in the study. A power analysis on a R package, WebPower [48] was performed, and the results suggested a good power for each path (≥ .8). The survey included demographic questions (age, gender) and three psychometric scales in order to measure i) perceived stress level, ii) temporal dissociation as induced by cognitive absorption while on SNs and iii) SN addiction. Data were collected through a web-based platform (Qualtrics, Provo, UT). All the collected data were analysed through SPSS 22.0, by performing Pearson's correlation and independent t-test analyses. All the required assumptions were met. The mediation model was tested using Model 6 in PROCESS, an SPSS macro for mediation, moderation, and conditional process modelling [49].

Perceived Stress Scale (PSS-10)

The Perceived Stress Scale (PSS) is an established diagnostic tool that is commonly used to measure stress levels, especially in research focused on the role of stress in the aetiology of diseases and behavioural disorders [50]. For the purpose of the current work, the Italian 10-items version of the scale was administered (PSS10) [51]. Respondents were asked to answer to questions about their self-assessed psychological state during the last month by using a 5-point Likert scale (from never = 0 to very often = 4). An example of an item is: "How often have you been upset because of something that happened unexpectedly?". The measure had a good internal consistency in the present sample (α = .79).

Bergen Social Media Addiction Scale (BSMAS)

To measure SN addiction, the 6-items Bergen Social Networking Addiction Scale (BSNAS), an adaptation of the Bergen Facebook Addiction Scale (BFAS) where the word "Facebook" is replaced with "social media", was administered [52,53]. The scale incorporates the theoretical framework of the addiction components of the biopsychosocial model [54]. The BSMAS was developed by selecting the 6 items with the highest possible factor loadings for each component (i.e., salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse) from a pool of 18 initial items. The 6 selected items are answered on a 5-point scale ranging from very rarely (1) to very often (5), thus yielding a sum score from 6 to 30 [55]. An example of an item is: "I spend a lot of time thinking about social media or planning how to use it". This scale has been validated with different samples, including non-student adults [56]. Such scales measure a person's level of addiction and a cut-off score marks the threshold beyond which subjects can be considered at risk of social media addiction [57, 58]. Even though there is no specific cut-off score for this scale, research suggests to set it at 19 for optimal separation of at-risk subjects from low- or no-risk ones, as highlighted by Bányai et al (2017) by means of sensitivity and specificity analysis [59]. In the present sample, the Cronbach's alpha of the BSMAS was = .85.

Cognitive Absorption Scale

To measure the level of cognitive absorption while on SNs, the cognitive absorption scale 25 was adapted by suitably inserting "using social media apps" in each item where appropriate. All construct items were measured on seven-point Likert scales from 1 = Strongly Disagree to 7 = Strongly Agree. The scale allows to assess five factors: focused immersion (the experience of total engagement where other attentional demands are, in essence, ignored), heightened enjoyment (the pleasurable aspects of the interaction),

control (the user's perception of being in charge of the interaction), curiosity (the extent to which the experience arouses an individual's sensory and cognitive curiosity) and temporal dissociation (the inability to register the passage of time while engaged in interaction), which was the factor of interest for the current study. An example of an item measuring temporal dissociation is: "Time appears to go by very quickly when I am using social networking apps on my smartphone". For the present sample, an α = .82 was found.

3. Results

Descriptive statistics and gender differences

About 14% of the sample reported a score indicating a risk of SN addiction (BSMAS score ≥ 19). Pearson correlation coefficients were computed to assess the relationship stress level, cognitive absorption (total score), temporal dissociation from cognitive absorption scale and SN addiction (Table 2). SN addiction was positively correlated with temporal dissociation (r = .503, $p < .001$) as well as with stress level (r = .292, $p < .001$) and cognitive absorption total score (r = .620, p <.001). A positive correlation was also found between temporal dissociation and stress level (r =.320, $p < .001$) and between stress level and cognitive absorption total score (r = .248, p <.001).

Table 1. Means (*M*), Standard Deviations (*SD*) and Pearson correlations (*r*) between variables. Note. *** p < 0.001.

	N	M	SD	1	2	3	4
1. SN Addiction	312	13.46	4.43	1	.503***	.292***	.620***
2. Temporal Dissociation	312	4.91	1.45	.503***	1	.320***	.843***
3. Perceived Stress	312	20.6	7.45	.292***	.320***	1	.248***
4. Cognitive Absorption (Total)	312	22.47	2.73	.620***	.843***	.248***	1

Then, in order to investigate gender differences in the study variables, a series of t-tests on the whole sample were performed with Bonferroni correction for multiple comparison (with adjusted α = .016). Inspection of Q-Q plots revealed that all the dependent variables were normally distributed for both groups. For all the three tested variables, Levene's test was found to be not significant, confirming homogeneity of variance. Results revealed a significant difference for two of the three variables, with female participants reporting significant higher perceived stress level and significant higher temporal dissociation compared to male participants (see Table 2). Not significant p-value (p = .07) was detected when comparing male and female participants on SN addiction scores.

Table 2. t-tests results comparing male and female (whole sample) on study variables. Mean (M), Standard Deviation (SD).

	Male N = 95		Female N = 217				
	M	**SD**	**M**	**SD**	***t* -test**	***p***	**Cohen's d**
Perceived Stress	17.29	7.10	22.04	7.15	- 5.40	.000	0.66
Temporal Dissociation	4.49	1.45	5.09	1.42	- 3.35	.001	0.41
SN Addiction	12.78	4.08	13.76	4.55	- 1.79	.07	0.22

Mediation Model

A mediation model was then run to study direct and indirect effects of X, the independent variable (Perceived Stress Level) on Y, the dependent variable (SN Addiction), while also modelling a process such that X causes Y through the intervention of a third

variable M (Temporal Dissociation). In this model, Perceived Stress Level is assumed to influence Temporal Dissociation during SN usage which then influences SN Addiction. As illustrated in Figure 1, the total effect (path c), is the sum of the direct effect of stress level on SN addiction (path c') and of indirect effects (path ab). The model was run allowing bootstrapping with 5000 samples. Bias-corrected point estimates for the indirect effects of the Stress Level on SN Addiction were calculated, together with standard errors and 95% confidence intervals (see Figure 1). A direct significant link between Stress level and SN Addiction (path c') was detected, with higher Stress level predicting more serious SN Addiction. Furthermore, results revealed that Stress level directly predicts Temporal Dissociation while on SNs (path a), suggesting that the higher the participants' stress level, the more they tend to feature Temporal Dissociation while on SNs. Moreover, Temporal Dissociation during SN usage was found to significantly predict SN Addiction (path b), which indicates a significant role of cognitive absorption in influencing university students' ' risk of SN Addiction (see Table 3). Finally, the total effect model was significant, $F(2,309) = 57.9$, $p = .000$, $R^2 = .27$.

Table 3. Mediation model predicting SN Addiction (N = 312). Coefficient, non-standardized B coefficients; SE, standard errors; CI, bias-corrected and accelerated 95% confidence interval; LL, lower limit; UL, upper limit; PSS, perceived stress score; TD, temporal dissociation; 5,000 bootstrap samples. Significant indirect effect in bold. Path coefficient significant at *** $p < .001$; ** $p < .01$.

		95% CI	
Path estimates	**Coefficient (SE)**	**LL**	**UL**
a	.06 (.011)***	.041	.083
b	1.38 (.156)***	1.082	1.695
c	.08 (.030)**	.027	.146
c'	.17 (.032)***	.110	.237
Indirect Effect	**Effect (SE)**	**LL**	**UL**
PSS→ TD → SN Addiction	**.086 (.017)**	**.055**	**.123**

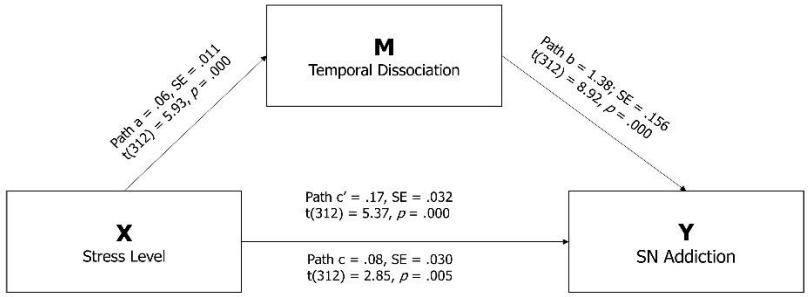

Figure 1. Mediation Model. SE = Standard Error.

4. Discussion

The purpose of this paper was, primarily, to evaluate the influence of perceived stress on SN addiction in a sample of university students during the COVID-19 pandemic. SN/Internet Addiction is currently a major public health issue. It has been shown for instance that limiting internet use of individuals with problematic online access habits has physiological and behavioural effects akin to those of abstinence from sedative or opiate drugs [60]. The issue seems to have been exacerbated by COVID-19-related lockdown

restrictions, which have turned online interaction into the only viable option for many [61, 62]. In view of its major relevance, the topic of social media behaviour and its related pathologies has been investigated from several disciplinary angles [63] with a view to developing effective strategies to cope with problematic and socially critical situations [64]. Our paper, in line with existing literature [43] has not found significant gender differences in SN addiction. However, significant differences in perceived stress level exist between male and female participants. This result aligns with evidence of higher perceived stress level in female college students during lockdown [65]. We also tested whether temporal dissociation due to cognitive absorption while on SNs mediated the relationship between perceived stress and SN addiction. As shown by mediation model results, perceived stress was found to be a significant positive predictor of SN addiction as well as of temporal dissociation. Moreover, temporal dissociation due to cognitive absorption was shown to predict SN addiction as well, in line with results presented in another study where the relationship between cognitive absorption and SN addiction was analysed through structural equation modelling [66]. Thus, the results of the mediation model suggest that higher levels of perceived stress directly predict stronger addiction to SNs, but also that when feeling more stressed there is an increased risk for temporal dissociation while on SNs – which, in turn, affects SN addiction. Our findings seem to support a possible functional interpretation of temporal dissociation as a cognitive coping strategy deployed to regulate internal and external stressors, as also suggested by the result that perceived coping self-efficacy directly and negatively predicts dissociation [67].

Our results agree with previous research showing that temporal dissociation predicts problematic internet use [68] and that temporal dissociation is conducive to longer time spent online, which is in turn associated with depression [69]. It is then possible to argue that, despite its potential role as a coping mechanism against stressful online experience, temporal dissociation induces dysfunctional forms of psychological adaptation that, by inducing addictive behaviours, may also threaten the subject's task performance on the job [70] and disrupt their capacity to attend to social duties and obligations [71].

5. Conclusion

Our results contribute to the exiting literature from a theoretical point of view, by investigating the association between stress and SN addiction during the pandemic. They also offer valuable policy insights, highlighting the role of subject-specific variables that can be experimentally manipulated and/or trained to curb temporal dissociation and thus, the risk of addiction. Intriguingly, it was recently reported that emotional regulation ability functions as mediator between negative affect and internet addiction [72]. Taken together, these findings seem to support the perspective that CBT protocols for Internet/SN Addiction [73] need to plan treatment interventions focusing on both cognitive (e.g., temporal dissociation) and emotional (e.g regulation) components of the condition, including physiological stress regulation [74]. Finally, the main limitation of our analysis is that we assessed SN addiction by taking into account several SNs at once. As a direction for future research, further studies are needed to investigate how the interface design and features of specific social networks facilitate or prevent temporal dissociation. Moreover, future studies should explore whether our results also apply to older adults, as technology-related attitudes have been found to be a relevant factor influencing perceived stress and its relationship with smartphone and internet use [75-77].

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Data Availability Statement: The datasets generated during and/or analysed the current study are available in the Open Science Framework repository: https://osf.io/kjb5n/?view_only=cb03e20ab6bf413aa0cc6ed6277d31a0

Conflicts of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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