Chapter

Adolescents Suspended in the Space-Time: Problematic Use of Smartphone between Dissociative Symptoms and Flow Experiences

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Abstract

Based on current digital culture, this chapter aims to provide an updated view of dissociative experiences as no-psychopathological symptoms of flow experiences. It has been hypothesized that prolonged exposures to smartphone screens could be a predictor of altered states of consciousness (flow) and that sometimes these prolonged exposures could degenerate into dissociative phenomena. Participants were 643 high school students aged between 13 and 23 years (M = 16.08; SD = 1.79). They were asked to answer four self-report questionnaires about the habits of smartphone usage, the perception of problematic smartphone use, and the assessment of dissociative symptoms and experiences (e.g., bizarre sensory experiences, absorption and imaginative involvement [AII], depersonalization and derealization). Gender differences emerged both in smartphone usage habits and some dissociative scales. Two gender-specific stepwise linear regressions showed that problematic smartphone use is one of the stronger predictors of dissociative symptoms. Results support the idea that in an adolescents' community sample prolonged exposition to smartphone screens plays a role in the manifestation of dissociative symptoms. This is closely connected with experiences of AII, which could reinforce the use of devices contributing significantly to establishing a causal circularity between smartphone prolonged usage and AII phenomena.

Keywords: smartphone overuse, flow experience, dissociative symptoms, digital habits, adolescents

1. Introduction

Typical images of our time show teenagers, side by side, with their eyes lost in their smartphones. Currently, the majority of children and teens prefer smartphones to connect online. The time spent online is difficult to estimate accurately, because with a smartphone always at hand "internet use has become continuous and interstitial, filling up the intervals between daily activities" ([1], p. 22).

Moreover, children and teens often do not perceive watching a series episode or a film by a subscription video on demand services (SVOD) as time spent online [1]. Nevertheless, it seems important to succeed in estimating the online spent time and the engaging activities to evaluate their psychological consequences too. It has been estimated that the time spent by Italian adolescents on social networks ranged from "less than an hour a day" (8%) to "I'm always connected" (4%), with a prevalence of "2/3 hours a day" (43%) [2]. If interacting through a social is a Bronfenbrenner's molar daily activity [3], it is also "a constraint on involvement in alternative activities" because time is finite ([4], p. 1188).

The smartphone is a device built to return immediate rewards during its use. Therefore, it is plausible to say that the various visual elements on the backlit screens function as "attentional facilitators" capable of helping the user to maintain an active, pleasant, and positive concentration on the action to the point of experiencing total absorption. Csíkszentmihályi [5, 6] defines as "flow experience" the total absorption in an activity, whereby a person loses the awareness of the surrounding space and its stimuli, including time and even physiological needs.

1.1 Flow experience

Flow is "the holistic sensation that people feel when they act with total involvement and the experience is so enjoyable that people will do it even at great cost, for the sake of doing it" ([5], p. 36). According to Csíkszentmihályi, the necessary condition for experiencing a state of flow is to perceive enjoyment and concentration. People who experience a state of flow will find an assuring pleasure in their activities that are perceived to be doing. The optimal experience is a flow of consciousness in which the person becomes one with the action he or she performs, is completely involved, and absorbed in the activity. This concept has been extensively studied and analyzed from different perspectives and in relation to many other factors, including time. Concentration is very intense, there is no time for problems or stimuli from the external environment. The sense of time becomes distorted, the experience is so satisfying that the person will do it just for the sake of it. The activity becomes so engaging that the person places him/herself in a condition of passivity toward time. It happens to everyone to be so immersed in reading or browsing online that they do not perceive the passage of time. This dynamic is very interesting if we think about how much flow can intervene in our daily commitments. Flow experiences sometimes occur by chance, other times they are actively sought by the person, they are sought because they are associated with a pleasant experience that provides satisfaction. Csíkszentmihályi [6] analyzed different types of activities to identify those that most frequently create an optimal experience condition. He found that the activities that give a sense of discovery, even if minimal, were the ones that put the person into a state of flow more frequently. Thus, the more interesting and stimulating the activity is, the more the likelihood that the person enters a state of flow increases. Boring activities or activities with a low creativity index limit the feeling of discovery in the person and therefore also the possibility of entering a state of flow. In this regard, we can remember that surfing online and social is very stimulating.

Surfing online, on social networks, or searching for information on Google allows us to always have an incentive to continue browsing, discover new things, and stay in the state of flow. Neuroscientific research has shown interesting data [7]: cortical activity decreases when people focus intensely on a task. Instead of increasing with effort, it seemed that the investment of attention decreased it. A different measurement also showed that people who focus intensely

on a specific task were more accurate in sustained attention tasks. This leads us to believe that flow contributes and influences concentration on the task. The more the individual focuses on browsing online, the more he/she has the feeling of being absorbed and external stimuli, including time, fade into the background (for a review see [7]).

Within the flow theory, concentration explains the individual's state of flow. One's addiction to smartphone usage requires a time-consuming flow where one spends full and unbroken concentration [8]. For an addiction to happen, one needs to acquire temporal and cognitive concentration on the task at hand. As the concentration intensifies, one can be said to be in a state of addiction [8]. Another term for concentration is "attention focus" [9]. It reflects users' immersion in doing something they prefer. Users may often concentrate on the smartphone which can lead to harmful consequences, especially on movement. When someone is focusing on using a smartphone in a dangerous place whereby right, they should focus on a task at hand such as in a subway or while driving, the use of smartphone is shifting their experience and attentional focus. Thus, the need to develop an in-depth analysis of concentration in smartphone addition is influential in understanding this addictive behavior [9].

In fact, we all experience flow on a daily basis and at many times of the day. We experience it while we are doing something that we know how to do very well or something we have learned so precisely and mechanically that we do not need to think while we do it. Flow can modify the perception of the passage of time and other individuals' emotional and cognitive processes. Sometimes prolonged exposures can degenerate into dissociative phenomena.

1.2 Visual display unit dissociative trance

The flow experience has some points in common with visual display unit (VDU) dissociative trance [10], a state that has been studied in people who experimented with a different state of consciousness while using computers for a prolonged time. In this case, it is referred to VDU dissociative trance as a clinical manifestation of compulsive use of technology that could lead to compromise people's daily lives.

However, some flow conditions seem non-pathological dissociative experiences, but they typically occur as moments of the day when you simply "go away" for a few seconds. Contrary to Caretti's views [10], we consider these VDU dissociative trances as a form of normative dissociation [11], which refers more specifically to the disconnection between the cognitive processes of thought, memory, sense of identity, and the rest of individual psychological systems.

Milton Erickson [12] was the first to realize that trance states are not extraordinary phenomena but are rather frequent events common to all people. The term "dissociation" means the separation of a part or group of mental processes from the rest of consciousness. The concept of "trance" describes an alteration of the state of consciousness like sleep, but with electroencephalographic waves like the waking state. During the trance state, people lose consciousness and contact with reality until they return to their normal conditions, often accompanied by amnesia. These alterations can be sudden or gradual, transitory, or chronic [13]. The state of trance implies dissociation. Thus, we speak of *non-pathological dissociation*, an alteration of the state of consciousness, which however is not part of a psychiatric disorder. Non-pathological dissociation typically involves the alteration or the temporary separation of normally integrated mental processes: these experiences include "daydreaming," the imagination and the absorption experienced in "normal" everyday experiences [14].

1.3 Aims and hypothesis of the study

This study aimed to explore the possible precursors of dissociative experiences associated with problematic smartphone usage.

It was hypothesized that: (a) extended exposures to smartphone screens could induce altered states of consciousness (flow) capable of modifying the perception of the passing time and other emotional and cognitive aspects of the individual; and (b) sometimes, if prolonged these altered states can degenerate into dissociative phenomena. Therefore, the hypothesis we tested with a community sample of adolescents are:

H1: Problematic use of smartphones is positively related to dissociative phenomena.

H2: The prolonged exposure to a smartphone's backlit screen is a predictor of different states of consciousness (flow).

2. Method

2.1 Participants

Participants were 643 students (337 males, 52.1%; 294 females, 46.0%; 12 undeclared-gender people, 1.9%) aged 13–23 years (M = 16.08; SD = 1.79). They were recruited in three public high schools in Messina (Italy): a random sampling of 24 first, third and fifth classes was carried out. Participants were presented with an informed consent form with the study aims and the authorization to detect personal data in accordance with Italian legislation. Underage participants were authorized by their parents.

2.2 Measures and procedure

A pen-and-paper self-report survey was applied. It consisted of:

a. A questionnaire (14 items) detecting participants' personal data (i.e., age and gender) and habits in smartphone usage. The items assessed through Likert point scales: (1) the frequency (1 = *never* to 4 = *always*) of some smartphone activities (i.e., social networking, playing a game, calling people, messaging, browsing, streaming, recording photos/videos, listening to music, shopping, and editing); and (2) other behavioral measures: (i) if in the past participants sometimes lied about the time they had spent online (1 = *never* to 4 = *always*); (ii) if they used their smartphone in bed before falling asleep (1 = *never* to 4 = *always*); (iii) if they have been constantly thinking about online activities even when they were not connected and were busy doing other things (1 = *never* to 4 = *always*); (iv) the time spent with smartphone and other devices (5 = *More than 5 h*, 4 = *Between 3 and 5 h*, 3 = *Between 1 and 3 h*, 2 = *Less than an hour*, and 1 = *Never*); (v) if in the last year the time spent on screen was: 3 = *increased*, 2 = *the same*, or 1 = *decreased*.

b. The *Smart_Q-R* [15], a questionnaire evaluating the perception of smartphone problematic use and the negative consequences experienced by respondents. The questionnaire lists 14 items with responses on a 4-points Likert scale (1 = *never* to 4 = *often*) and reports thoughts and ideas that guide adolescents' online behaviors and smartphone addiction. Indeed, some items investigate teenagers' impulse to connect, to check notifications, to use the smartphone to escape unpleasant thoughts; an item investigates the night-time

smartphone's usage, others items help to investigate adolescents' behavior in social decision making (e.g., choosing between meeting a friend *in vivo* or contacting him/her through the smartphone).

The scale is monofactorial. The score is obtained by adding the points of each item (range 14–56): The higher the score, the more intense the involvement in the use of the smartphone. In this study, the reliability of the scale was confirmed to be good (Cronbach's alpha = .80).

c. The Dissociation scale of the *Internet Use, Abuse, Addiction* (UADI) [16]. UADI is an Italian questionnaire composed of 75 items with responses on 5-points Likert scale (1 = *absolutely false* to 5 = *totally true*). The UADI consists of five different scales that allow to investigate the degree of impairment of adolescent behavior in relation to Internet use. For this research, only the 15-item Dissociation (Dis) subscale was used.

   The DisUADI scale presents a list of items describing some dissociative symptoms such as bizarre sensory experiences, depersonalization, derealization, tendency to alienate or to escape from reality, that are thought to be associated with long exposure to Web surfing. In this study, the DisUADI scale has been modified from the original to make it more suitable for the modern use of internet access by smartphone. Very good the reliability in this study (Cronbach's alpha = .85).

d. The *Adolescent Dissociative Experience Scale* (A-DES), a 30-item questionnaire about the dissociative experiences that people can usually have in their everyday life [17]. The Italian version developed by Schimmenti [18] was used. Respondents were asked to answer (from 0 = *never* to 10 = *always*) about the frequency of the experiences they had had in specific situations. The A-DES total score is equal to the mean of all item scores. Four subscale scores can also be calculated in the following areas: *dissociative amnesia* (e.g., sense of loss during action executions, lack of memories of what has just been done, perceived past events as fragmentary, and so on), *absorption and imaginative involvement* (e.g., dissociative phenomena linked to the sense of time-related to the activities, the degree of attentional involvement experienced, and to confusion about the actions in progress, with a mixture of reality and imagination), *depersonalization and derealization* (e.g., mind-body-context dissociations, phenomena of "identity fluctuation," and a sense of estrangement from oneself), and *passive influence* (i.e., the passivity of the individual with regard to the actions performed by him/herself, as if actions did not depend on his/her will and therefore they were suffered) [19]. In this study, for all subscales reliability was acceptable (Cronbach's alpha = .77 for dissociative amnesia; .69 for absorption and imaginative involvement; .88 for depersonalization and derealization; .76 for passive influence), and excellent for A-DES total (alpha = .93).

After the principal's authorization, the questionnaires were collectively administered in every classroom under the supervision of two of the study authors.

2.3 Data analysis

First, distribution statistics for all measures were calculated and then group differences (males *vs.* females) were tested through *F* tests (ANOVAs and MANOVAs). Subsequently, measure associations by Pearson's *r* coefficients were

estimated. Finally, two stepwise linear regressions were calculated to identify predictor factors of DisUADI scores. Data were processed with IBM SPSS Statistics for Windows 19.0.

3. Results

3.1 Habits and time on the web

Only two out of 643 people (0.3%) did not have their own smartphones. What habits did the participants highlight? **Table 1** shows mean frequencies of males and females related to some typical behaviors with this device assessed by specific items of the smartphone-usage questionnaire.

Gender differences (m *vs.* f) were tested through a multivariate analysis of variance (MANOVA) with the 10 behavior frequencies as dependent variables. MANOVA revealed a significant multivariate test (Pillai's trace = 0.239, $p < 0.001$, < 0.001, $\eta_p^2 = 0.24$) and several significant effect tests (**Table 2**).

Overall, messaging, social networking, listening to music, and browsing were the preferred activities. Males play games and watch streaming videos significantly more than females; females attend social networks, send messages, record photos, and videos, and listen to music significantly more than males.

Behavior	Gender	Mean	*SD*
Social networking	Male	3.10	0.81
	Female	3.46	0.67
Playing a game	Male	2.44	0.84
	Female	1.87	0.68
Calling people	Male	2.59	0.74
	Female	2.66	0.66
Messaging	Male	3.37	0.71
	Female	3.63	0.54
Browsing	Male	3.04	1.30
	Female	3.02	0.72
Streaming	Male	2.99	0.78
	Female	2.76	0.81
Recording photos/videos	Male	2.17	0.72
	Female	2.69	0.79
Listening to music	Male	3.19	0.77
	Female	3.34	0.75
Shopping	Male	1.76	0.74
	Female	1.76	0.79
Editing (filters, meme, etc.)	Male	1.65	0.78
	Female	1.75	0.83

Table 1.
Estimated frequencies were rated through a Likert scale: 1 = never, *2* = sometimes, *3* = often, *and 4* = always.

Source	Dependent variable	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Gender	Social networking	20.780	1	20.780	37.033	**< 0.001**	0.057
	Playing a game	49.520	1	49.520	83.994	**< 0.001**	0.120
	Calling people	0.795	1	0.795	1.611	0.205	0.003
	Messaging	10.770	1	10.770	26.606	**< 0.001**	0.041
	Browsing	0.072	1	0.072	0.063	0.803	0.000
	Streaming	7.897	1	7.897	12.546	**< 0.001**	0.020
	Recording photos/videos	42.668	1	42.668	75.458	**< 0.001**	0.109
	Listening music	3.415	1	3.415	5.866	**0.016**	0.009
	Shopping	1.079×10^{-6}	1	1.079×10^{-6}	0.000	0.999	0.000
	Editing	1.388	1	1.388	2.168	0.141	0.003
Error	Social networking	346.775	618	0.561			
	Playing a game	364.357	618	0.590			
	Calling people	304.889	618	0.493			
	Messaging	250.151	618	0.405			
	Browsing	707.283	618	1.144			
	Streaming	388.973	618	0.629			
	Recording photos/videos	349.453	618	0.565			
	Listening music	359.777	618	0.582			
	Shopping	356.671	618	0.577			
	Editing	395.606	618	0.640			

SS = *sum of squares;* df = *degrees of freedom; and* MS = *mean of squares.*
Significant results are in boldface.

Table 2.
Statistics of between-subjects effect tests from the MANOVA males vs. *females with behavior frequencies as dependent variables* (N = 620).

On average, women always rated that they were more active than men in all other measures of the smartphone usage questionnaire, except gaming by a console. Some of these differences were highly significant (**Table 3**).

Males and females differed also for *Smart_Q-R* scores: $M_m = 29.21$, $SD_m = 6.24$, *vs.* $M_f = 31.53$, $SD_f = 6.81$, $MS_e = 42.394$, $F(1, 629) = 19.941$, $p < 0.0001$, $\eta_p^2 = 0.031$. With a range of 14–56, women revealed greater involvement than men in smartphone use.

3.2 Dissociative phenomena

Some differences related to dissociative phenomena between men and women emerged too.

In relation to the DisUADI scale, over a range of points from 15 to 75, the group of participants averaged 32.98 ($SD = 9.76$, $N = 625$). Women scored significantly higher (**Tables 4** and **5**).

Differently with the A-DES – Total, which is a measure developed for adolescents (average score ranging between 1 and 10), this group of participants settled on an average score of 2.09 ($SD = 1.59$, $N = 628$), with no significant difference between males and females. Indeed, differences emerged for the AII and DD subscales, but not for DA and PI subscales (**Tables 4** and **5**).

Behavior	Gender	Mean	*SD*	*N*	*F* (*df*)	MS_e	*p*	η_p^2
Lying about the time spent online[1]	Male	1.50	0.70	335	0.22 (1, 626)	0.12	0.637	0.000
	Female	1.53	0.73	293				
Using smartphone in bed before falling asleep[1]	Male	3.12	0.93	335	7.44 (1, 626)	6.15	**0.007**	0.012
	Female	3.32	0.89	293				
Constantly thinking about online activities[1]	Male	1.91	0.71	335	1.57 (1, 626)	0.81	0.211	0.002
	Female	1.98	0.74	293				
Time spent on								
smartphone or tablet[2]	Male	2.70	0.87	334	19.81 (1, 624)	0.79	< **0.0001**	0.031
	Female	3.01	0.91	292				
messaging[2]	Male	2.83	1.03	334	27.95 (1, 624)	0.94	< **0.0001**	0.043
	Female	3.24	0.89	292				
gaming by console (PlayStation, etc.)[2]	Male	2.70	1.29	336	318.12 (1, 627)	1.04	< **0.0001**	0.337
	Female	1.25	0.57	293				
in front of a computer each day[2]	Male	2.20	1.09	336	1.07 (1, 626)	1.02	0.301	0.002
	Female	2.11	0.90	292				
In the last year, time spent on screen[3]	Male	2.00	0.75	331	9.82 (1, 622)	0.56	**0.002**	0.016
	Female	2.19	0.74	293				

df = *degrees of freedom; and* MS_e = *error mean of squares.*
Significant results are in boldface.

Table 3.
Descriptive (means and standard deviations) and inferential statistics (univariate ANOVAs – Males vs. *females) of other smartphone usage measures estimated by participants: [1]frequencies were expressed through four points (1* = never, *2* = sometimes, *3* = often, *4* = always*); [2]time was estimated through five points (5* = more than 5 h, *4* = between 3 and 5 h, *3* = between 1 and 3 h, *2* = less than an hour, *and 1* = never*); [3]duration was estimated through three points (3* = increased, *2* = same, *1* = decreased*).*

Dissociative measures	Gender	Mean	*SD*
DisUADI	Male	31.54	9.13
	Female	34.60	10.21
A-DES – DA	Male	1.81	1.67
	Female	1.82	1.80
A-DES – AII	Male	2.16	1.62
	Female	2.53	1.78
A-DES – DD	Male	1.67	1.60
	Female	1.94	1.87
A-DES – PI	Male	2.33	1.92
	Female	2.49	2.14
A-DES – Total	Male	1.99	1.50
	Female	2.19	1.68

DisUADI = dissociation scale of internet use, abuse, addiction questionnaire; A-DES = adolescent dissociative experience scale; DA = dissociative amnesia; AII = absorption and imaginative involvement; DD = depersonalization and derealization; and PI = passive influence.

Table 4.
Means and standard deviations of dissociative measures (males = 332 for DisUADI, 334 for A-DES; females = 293 for DisUADI, 294 for A-DES).

Source	Dependent variable	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Gender	DisUADI	1459.202	1	1459.202	15.674	**< 0.0001**	0.025
	A-DES – Total	6.400	1	6.400	2.535	0.112	0.004
	A-DES – DA	0.014	1	0.014	0.005	0.945	0.000
	A-DES – AII	21.377	1	21.377	7.460	**0.006**	0.012
	A-DES – DD	11.408	1	11.408	3.813	**0.051**	0.006
	A-DES – PI	3.993	1	3.993	0.978	0.323	0.002
Error	DisUADI	57998.485	623	93.095			
	A-DES – Total	1562.707	626	2.496			
	A-DES – DA	1877.722	626	3.000			
	A-DES – AII	1793.715	626	2.865			
	A-DES – DD	1872.794	626	2.992			
	A-DES – PI	2556.366	626	4.084			

DisUADI = dissociation scale of internet use, abuse, addiction questionnaire; A-DES = adolescent dissociative experience scale; DA = dissociative amnesia; AII = absorption and imaginative involvement; DD = depersonalization and derealization; PI = passive influence; SS = *sum of squares;* df = *degrees of freedom; and* MS = *mean of squares. Significant results are in boldface.*

Table 5.
Statistics of between-subjects effect tests (males vs. *females) from ANOVAs for DisUADI (*N = *625) and A-DES Total (N = 628) measures, and from the MANOVA for A-DES subscales (multivariate test: Pillai's trace = 0.031,* p = *0.001,* η_p^2 = *0.03).*

If the group means scores are relatively low, the large variability around the means reveals that several dissociative phenomena occurred. The A-DES standards state that a score of 4 can be considered the cut-off value for a presence of dissociative phenomena out the normality [17]. In the A-DES total score, 48 men (14.37%) and 59 women (20.02%) achieved scores of 4 or higher; the highest score was 9 from a single male participant. By dichotomizing the groups into participants who have A-DES scores less than 4 or equal/greater than 4, a two-by-two contingency table revealed the non-independence of two factors: $\chi^2(1, N = 628) = 4.01$, $p = 0.045$, two-ways.

3.3 Regression analysis

The next step of the analysis was the estimate of the associations between all the measures, differentiating males from females, since the two groups showed significantly different percentages of dissociative experiences.

The analysis of the associations revealed numerous and interesting correlations between smartphone behavioral habits, the *Smart_Q-R* scores, and the dissociation scales. These results are reported in **Tables 6–10**.

Two separate stepwise linear regressions (for male and female groups), with DisUADI measures as dependent variables and smartphone usage behaviors, *Smart-Q-R* indexes, and A-DES subscale and total scores as predictors were performed. The analysis revealed that the strongest predictors were A-DES total score for men and *Smart_Q-R* index for women, respectively (**Table 11**).

4. Discussion

Analysis revealed several differences in smartphone preferred activities as a function of users' gender. Some of these differences were expected: women more

Male behaviors		Smart_Q-R	DisUADI	A-DES – DA	A-DES – AII	A-DES – DD	A-DES – PI	A-DES – Tot
Social networking	*r*	0.216	−0.014	−0.010	−0.013	−0.012	−0.020	−0.015
	p	<0.001	0.801	0.854	0.811	0.827	0.711	0.791
	N	335	330	332	332	332	332	332
Playing a game	*r*	0.170	0.185	0.157	0.203	0.096	0.090	0.146
	p	0.002	0.001	0.004	<0.001	0.079	0.101	0.008
	N	336	331	333	333	333	333	333
Calling people	*r*	0.090	0.048	0.064	0.047	0.027	0.058	0.051
	p	0.100	0.380	0.243	0.390	0.621	0.288	0.356
	N	335	330	332	332	332	332	332
Messaging	*r*	0.210	−0.042	0.053	0.078	0.041	0.032	0.055
	p	<0.001	0.449	0.331	0.155	0.451	0.566	0.316
	N	336	331	333	333	333	333	333
Browsing	*r*	0.216	0.132	0.058	0.130	0.085	0.042	0.089
	p	<0.001	0.016	0.289	0.018	0.123	0.441	0.105
	N	335	330	332	332	332	332	332
Streaming	*r*	0.151	0.157	0.103	0.148	0.093	0.013	0.101
	p	0.005	0.004	0.060	0.007	0.090	0.813	0.064
	N	336	331	333	333	333	333	333
Recording photos/videos	*r*	0.072	−0.055	−0.008	−0.043	−0.038	−0.025	−0.033
	p	0.188	0.322	0.889	0.437	0.489	0.656	0.547
	N	335	330	332	332	332	332	332
Listening to music	*r*	0.025	0.035	0.087	0.115	0.127	0.102	0.123
	p	0.649	0.523	0.115	0.037	0.021	0.064	0.025
	N	335	330	332	332	332	332	332
Shopping	*r*	0.051	0.020	0.031	0.010	0.044	0.010	0.032
	p	0.350	0.723	0.570	0.861	0.419	0.853	0.564
	N	335	330	332	332	332	332	332
Editing (filters. Meme. etc.)	*r*	0.156	0.126	0.141	0.141	0.125	0.119	0.147
	p	0.004	0.022	0.010	0.010	0.023	0.031	0.007
	N	335	330	332	332	332	332	332

Table 6.
Pearson's r *coefficients between typical smartphone habits and* Smart_Q-R *and dissociation measures of male group. Significance (*p*) levels and* N*s are reported too.*

attended socials and were more engaged in relational behaviors than men; instead, men resulted more engaged in playing games and watching videos by streaming than women. These results are literature confirmations [20].

However, more interesting were the gender differences related to the measures of smartphone overuse and dissociative phenomena. Indeed, women estimated more frequent smartphone usage than men. Women also reported more dissociative phenomena. This gender difference results from both when the mean group scores on the DisUADI are considered, and when percentages of scores equal to/above the

Female behaviors		Smart_Q-R	DisUADI	A-DES – DA	A-DES – AII	A-DES – DD	A-DES – PI	A-DES – Tot
Social networking	*r*	0.274	0.101	0.045	0.057	−0.030	0.044	0.019
	p	<0.001	0.083	0.445	0.331	0.611	0.448	0.740
	N	293	292	293	293	293	293	293
Playing a game	*r*	0.057	0.093	0.106	0.146	−0.003	−0.011	0.054
	p	0.329	0.114	0.072	0.012	0.961	0.850	0.357
	N	292	291	292	292	292	292	292
Calling people	*r*	−0.109	−0.113	−0.047	−0.018	−0.057	−0.055	−0.052
	p	0.064	0.054	0.427	0.758	0.334	0.352	0.375
	N	291	290	291	291	291	291	291
Messaging	*r*	0.196	0.010	0.019	0.085	0.034	0.037	0.046
	p	0.001	0.868	0.752	0.148	0.564	0.528	0.437
	N	294	293	294	294	294	294	294
Browsing	*r*	0.203	0.134	0.017	0.009	−0.011	−0.004	0.001
	p	<0.001	0.022	0.766	0.882	0.857	0.950	0.987
	N	293	292	293	293	293	293	293
Streaming	*r*	0.311	0.278	0.145	0.180	0.115	0.129	0.153
	p	<0.001	<0.001	0.013	0.002	0.050	0.027	0.009
	N	293	292	293	293	293	293	293
Recording photos/videos	*r*	0.115	0.034	0.085	0.082	0.088	0.077	0.094
	p	0.050	0.565	0.149	0.160	0.131	0.188	0.108
	N	292	291	292	292	292	292	292
Listening to music	*r*	0.177	0.132	0.133	0.173	0.171	0.167	0.182
	p	0.002	0.024	0.023	0.003	0.003	0.004	0.002
	N	292	291	292	292	292	292	292
Shopping	*r*	0.175	0.016	−0.021	−0.149	−0.041	−0.075	−0.071
	p	0.003	0.786	0.724	0.011	0.487	0.200	0.228
	N	292	291	292	292	292	292	292
Editing (filters. Meme. etc.)	*r*	0.242	0.190	0.101	0.138	0.119	0.118	0.132
	p	<0.001	0.001	0.086	0.018	0.043	0.043	0.024
	N	292	291	292	292	292	292	292

Table 7.
Pearson's r *coefficients between smartphone habits and* Smart_Q-R *and dissociation measures of female group. Significance (*p*) levels and* N*s are reported too.*

4-point cutoff in A-DES are compared. Women showed higher scores than men in *absorption and imaginative involvement* and *depersonalization and derealization* subscales of A-DES too.

These differences suggested to analyze separately women and men associations between study variables. Numerous significant associations were found for both groups. Several associations resulted weak (*r* indices less than 0.30): both genders highlighted dissociative measures correlating with perceived daily time spent with the smartphone, in messaging, and in front of a computer, with the feeling that

Male behaviors		Smart_Q-R	DisUADI	A-DES – DA	A-DES – AII	A-DES – DD	A-DES – PI	A-DES – Tot
Lying about the time spent online	*r*	0.311	0.353	0.248	0.204	0.234	0.153	0.243
	p	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001
	N	335	330	332	332	332	332	332
Using smartphone in bed before falling asleep	*r*	0.335	0.139	0.175	0.135	0.145	0.194	0.179
	p	<0.001	0.011	0.001	0.014	0.008	<0.001	0.001
	N	335	330	332	332	332	332	332
Constantly thinking about online activities	*r*	0.432	0.374	0.229	0.206	0.168	0.144	0.208
	p	<0.001	<0.001	<0.001	<0.001	0.002	0.008	<0.001
	N	335	330	332	332	332	332	332
Time spent on: smartphone or tablet	*r*	0.353	0.191	0.192	0.078	0.140	0.107	0.150
	p	<0.001	<0.001	<0.001	0.156	0.011	0.051	0.006
	N	334	329	331	331	331	331	331
messaging	*r*	0.236	0.072	0.119	0.021	0.083	0.013	0.074
	p	<0.001	0.190	0.030	0.702	0.131	0.810	0.179
	N	334	329	331	331	331	331	331
gaming by console (PlayStation, etc.)	*r*	0.055	0.054	0.122	0.143	0.074	0.002	0.095
	p	0.315	0.328	0.026	0.009	0.180	0.970	0.084
	N	336	331	333	333	333	333	333
in front of a computer each day	*r*	0.120	0.173	0.167	0.112	0.170	0.116	0.166
	p	0.028	0.002	0.002	0.040	0.002	0.034	0.002
	N	336	331	333	333	333	333	333
In the last year, time spent on screen	*r*	0.242	0.134	0.116	0.151	0.087	0.076	0.118
	p	<0.001	0.015	0.036	0.006	0.114	0.171	0.033
	N	331	326	328	328	328	328	328

Table 8.
Pearson's r *coefficients between other smartphone habits and* Smart_Q-R *and dissociation measures of male group. Significance (*p*) levels and* N*s are reported too.*

annual time spent on-screen increased, and with more frequent use of smartphone before falling asleep.

However, stronger indices (($r > 0.30$) emerged between DisUADI scores and the estimates of two specific behaviors: *overthinking* (i.e., constantly thinking about online activities even when he/she was not connected and was busy doing other things) and *lying* (i.e., if in the past he/she sometimes lied about the time he/she had spent online). Similarly, *Smart_Q-R* scores resulted strongly associated with all dissociative scales in both groups, particularly to DisUADI scores.

In both genders DisUADI scale resulted strongly associated also with the A-DES scale and subscales: this is a proof of concurrent validity.

Therefore, at this point, we wondered which was the best predictor of the DisUADI index and if predictors would have been different for men and women. Some differences emerged again. In both male and female groups, A-DES total score and *Smart_Q-R* emerged as the strongest predictors, but in reverse order: for men, A-DES total was the strongest one, for women the *Smart_Q-R*. These two measures

Female behaviors		Smart_Q-R	DisUADI	A-DES – DA	A-DES – AII	A-DES – DD	A-DES – PI	A-DES – Tot
Lying about the time spent online	*r*	0.450	0.455	0.242	0.289	0.286	0.281	0.309
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	N	293	292	293	293	293	293	293
Using smartphone in bed before falling asleep	*r*	0.367	0.209	0.128	0.124	0.150	0.105	0.147
	p	<0.001	<0.001	0.029	0.034	0.010	0.072	0.012
	N	293	292	293	293	293	293	293
Constantly thinking about online activities	*r*	0.547	0.467	0.208	0.230	0.232	0.247	0.257
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	N	293	292	293	293	293	293	293
Time spent on: smartphone or tablet	*r*	0.384	0.222	0.088	0.088	0.118	0.145	0.124
	p	<0.001	<0.001	0.133	0.133	0.044	0.013	0.034
	N	292	291	292	292	292	292	292
messaging	*r*	0.252	0.071	0.030	−0.009	0.030	0.052	0.030
	p	<0.001	0.226	0.608	0.882	0.613	0.375	0.609
	N	292	291	292	292	292	292	292
gaming by console (PlayStation, etc.)	*r*	0.094	0.161	0.111	0.103	0.103	0.073	0.111
	p	0.108	0.006	0.057	0.078	0.080	0.212	0.058
	N	293	292	293	293	293	293	293
in front of a computer each day	*r*	0.195	0.260	0.151	0.145	0.137	0.059	0.142
	p	0.001	<0.001	0.010	0.013	0.019	0.311	0.015
	N	292	291	292	292	292	292	292
In the last year, time spent on screen	*r*	0.297	0.214	0.015	0.085	0.018	0.023	0.035
	p	<0.001	<0.001	0.803	0.148	0.755	0.696	0.553
	N	293	292	293	293	293	293	293

Table 9.
Pearson's r *coefficients between other smartphone habits and* Smart_Q-R *and dissociation measures of the female group. Significance (*p*) levels and* N*s are reported too.*

alone accounted for 41% and 53% of the variance by male and female group, respectively. The two measures together accounted for 51% and 63% of the variance by male and female group, respectively.

If we look at the other variables entered the models, in the male group three variables emerged that explained another 0.04% of the variance; in the female group, five variables emerged that explained another 0.03% of the variance: a negligible contribution for both groups, even if some of these variables (such as overthinking) had shown a strong positive correlation index.

These results suggest taking into consideration the *Smart_Q-R* index above all to explain the dissociative phenomena measured with the DisUADI. The *Smart_Q-R* index summarizes an estimate of the intensity of 14 behaviors (e.g., frequency of connections, positive mood and facilitation of social relationships, and so on) foreshadowing an unhealthy overuse of the smartphone if it is high [21]. Some of the *Smart_Q-R* behaviors are typical behaviors referred to flow (e.g., lack of perception of passing time) or to dissociative experiences (e.g., sense of alienation when connected). Therefore, the strict associations that emerged between

Scales		Smart_Q-R	DisUADI	A-DES – DA	A-DES – AII	A-DES – DD	A-DES – PI	A-DES – Tot
Smart_Q-R	*r*	—	0.733	0.401	0.369	0.417	0.384	0.445
	p		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	N		293	294	294	294	294	294
DisUADI	*r*	0.601	—	0.585	0.548	0.556	0.506	0.618
	p	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001
	N	332		293	293	293	293	293
A-DES – DA	*r*	0.465	0.578	—	0.756	0.750	0.718	0.897
	p	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001
	N	334	331		294	294	294	294
A-DES – AII	*r*	0.440	0.568	0.718	—	0.645	0.640	0.824
	p	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001
	N	334	331	334		294	294	294
A-DES – DD	*r*	0.396	0.609	0.733	0.700	—	0.780	0.934
	p	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001
	N	334	331	334	334		294	294
A-DES – PI	*r*	0.323	0.504	0.667	0.681	0.763	—	0.874
	p	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001
	N	334	331	334	334	334		294
A-DES – Tot	*r*	0.457	0.643	0.874	0.851	0.936	0.864	—
	p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
	N	334	331	334	334	334	334	

Table 10.
Pearson's r *coefficients between* Smart_Q-R *and dissociation measures of male (below the diagonal) and female (above the diagonal) groups. Significance (*p*) levels and* N*s are reported too.*

Smart_Q-R, DisUADI and A-DES scores in both regressions supported the idea that smartphone overuse can induce flow and dissociative experiences, especially in the female gender.

Why did women seem more vulnerable than men? The results of this study say that female participants were above all more intense smartphone users than men. An aim for future research is to find out which model of smartphone using is more likely to activate dissociative phenomena: this study suggests various potential behaviors (e.g., overthinking, streaming, playing games, etc.) but without one more strongly emerging.

5. Conclusions

Currently, the demand for the use of mobile devices to communicate, have fun and relax, read and study, search for information, etc., is so intense that it is impossible to escape it. Particularly, adolescents need to stay connected through their devices to be updated on the activities of the group and peers and to extend the

Gender	Model	Predictor	*B*	*SE B*	*β*	*t*	R_c^2	*F per* ΔR^2
Male	Step 1	A-DES – Tot	3.91	0.26	0.64	15.191***	0.406	230.78***
	Step 2	A-DES – Tot	2.92	0.26	0.48	11.278***	0.514	75.51***
		Smart_Q-R	0.53	0.61	0.37	8.690***		
	Step 3	A-DES – Tot	2.88	0.25	0.47	11.347***	0.535	15.77***
		Smart_Q-R	0.58	0.06	0.40	9.507***		
		Messaging	−1.94	0.49	−0.15	−3.971***		
	Step 4	A-DES – Tot	2.86	0.25	0.47	11.446***	0.548	11.09***
		Smart_Q-R	0.50	0.07	0.35	7.651***		
		Messaging	−1.90	0.48	−0.15	−3.952***		
		Constantly thinking a. online activities	1.74	0.52	0.14	3.330***		
	Step 5	A-DES – Tot	2.79	0.25	0.48	11.176***	0.554	5.14*
		Smart_Q-R	0.48	0.07	0.33	7.249***		
		Messaging	−1.75	0.48	−0.14	−3.629***		
		Constantly thinking a. online activities	1.45	0.54	0.11	2.707**		
		Lying a. time spent online	1.17	0.52	0.09	2.266*		
Female	Step 1	Smart_Q-R	1.09	0.06	0.73	19.052***	0.526	325.874***
	Step 2	Smart_Q-R	0.84	0.06	0.56	14.234***	0.632	85.055***
		A-DES – Tot	2.22	0.24	0.37	9.223***		
	Step 3	Smart_Q-R	0.88	0.06	0.59	14.895***	0.645	11.927***
		A-DES – Tot	2.18	0.24	0.36	8.218***		
		Messaging	−2.30	0.67	−0.12	−3.454***		
	Step 4	Smart_Q-R	0.82	0.06	0.55	12.991***	0.653	7.255**
		A-DES – Tot	2.09	0.24	0.35	8.878***		
		Messaging	−2.21	0.67	−0.12	−3.343***		
		Lying a. time spent online	1.46	0.54	0.11	2.694**		
	Step 5	Smart_Q-R	0.79	0.06	0.53	12.409***	0.662	9.044**
		A-DES – Tot	2.04	0.23	0.34	8.758***		
		Messaging	−2.08	0.65	−0.11	−3.194**		
		Lying a. time spent online	1.62	0.54	0.12	3.010**		
		Time spent at computer	1.19	0.40	0.11	3.007**		
	Step 6	Smart_Q-R	0.78	0.06	0.52	12.389***	0.666	4.219*
		A-DES – Tot	1.18	0.48	0.20	2.469*		
		Messaging	−2.01	0.65	−0.12	−3.095**		
		Lying a. time spent online	1.72	0.54	0.12	3.196**		
		Time spent at computer	1.16	0.40	0.10	2.936**		
		A-DES – DD	0.89	0.43	0.16	2.054*		
	Step 7	Smart_Q-R	0.71	0.07	0.48	10.128***	0.670	4.683*
		A-DES – Tot	1.12	0.48	0.19	2.356*		
		Messaging	−1.99	0.65	−0.11	−3.074**		
		Lying a. time spent online	1.68	0.53	0.12	3.150**		
		Time spent at computer	1.15	0.39	0.10	2.916**		
		A-DES – DD	0.95	0.43	0.17	2.194*		
		Constantly thinking a. online activities	1.21	0.56	0.09	2.164*		

*$p \leq 0.05$.
**$p \leq 0.01$.
***$p \leq 0.001$.

Table 11.
Stepwise-linear regression analysis for the male and female groups: Dependent variable DisUADI.

school time of interactions. The time to devote to all these societal demands is increasing, so they are needed to always remain connected.

In this digital cultural context, the time that teenagers have to dedicate to viewing their smartphone backlit screens is enormously dilated. In this context, the outcome of compulsive and problematic smartphone use becomes highly probable [22, 23]. If this happens, it is not uncommon to experience a complete absorption in the activity that is taking place with the smartphone, encountering flow experiences [24, 25].

The study presented in this chapter finds precisely the prolonged use of the smartphone as an important precursor of the dissociative experiences declared by a convenience sample of adolescents. Experiencing complete absorption in the activity that is taking place can reinforce the activity itself and thus initiate a circular causality loop that reinforces the problematic use of the device and leads to dissociative experiences.

The study has some limitations: the individual characteristics (e.g., extroversion, sensation seeking, or sensitivity to rewards) were not investigated. Some personal characteristics could shed light on different dispositions/risk factors regarding problematic smartphone use [26] and therefore the predisposition to dissociation. Furthermore, the data do not show a clear direction of causality between problematic smartphone use and levels of dissociation, but an evident concomitance that represents a start for the study of dissociative phenomena connected to the overuse of backlit screens. This research line could serve to redefine the concept of VDU dissociative trance in terms of cognition and flow experiences. Understanding the nature of these processes will help to understand the "suspensive" and dissociated risk of the digital mind and to prevent psychopathological problems through the correct use of digital technology while respecting human neurodevelopment.

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