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ORIGINAL ARTICLE

Relationship between autism traits and withdrawal effects in high internet users

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Abstract

OBJECTIVE: The study assessed whether the immediate impact of internet exposure on the mood of those who report more internet-based problem behaviors is moderated by autistic traits. It has been suggested that patterns of internet use may serve different functions in those with Autism Spectrum Disorders, which may protect them from internet addiction problems, such as withdrawal effects.
DESIGN: Participants were given a battery of psychological tests to explore levels of internet addiction, autism traits, depression, and current mood. They were then given exposure to the internet for 15min, and re-tested for mood.
RESULTS: High internet users also showed a pronounced decrease in mood following internet use compared to the low internet-users. This effect was not mitigated by levels of autism traits.
CONCLUSION: The results suggest that those with higher numbers of autism traits are just as likely to experience withdrawal-like effects on stopping using the internet as those with lower AQ scores.

Introduction

There are emerging concerns related to the long-term impacts of computer technology on psychological functioning (Cerniglia *et al* 2017; Kuss *et al* 2013). For example, excessive internet usage has been found to produce problems similar to behavioral addictions (Kuss *et al* 2014). Such an Internet Addiction Disorder (IAD; Kuss *et al* 2014; Young 1998) has been characterized as including a need to engage in increasingly longer periods of internet use (Hardie & Tee 2007; Starcevic 2013), an attenuation of mood when separated from the internet (Kross *et al* 2013; Romano *et al* 2013), and disruptions to everyday functions (Bozoglan *et al* 2013; Lin *et al* 2013; Shaw & Black 2008).

Several characteristics of people prone to develop IAD, such as depression (Gundogar *et al* 2012; Kuss *et al* 2014), social isolation (Shirasaka *et al* 2016), and social anxiety (Lin *et al* 2013; Weinstein *et al* 2015), are associated with Autism Spectrum Disorder (ASD), especially for higher-functioning individuals with ASD (Ghaziuddin *et al* 2002; Reed 2016), or even for non-diagnosed individuals who score highly on the broad autistic phenotype (Liss *et al* 2008). This latter category of individual is of increasing concern, as it is recognized that autism-traits are distributed throughout the population (De Groot & Van Strien 2017), and that many

individuals with high-functioning ASD may be undiagnosed (Dworzynski *et al* 2012). Additionally, cognitive problems associated with ASD, such as executive dysfunction (Hill 2004), have also been observed in those who display signs of IAD (Ko *et al* 2010; Zhou *et al* 2016).

Computer-based assistive technology plays an increasingly large role in supporting individuals with ASD (Constantin *et al* 2017; Root *et al* 2017; Spence-Cochran & Pearl 2012). This is the case for individuals with lower (Constantin *et al* 2017) and higher (Lacava *et al* 2007) levels of functioning. Assistive technology has been employed to facilitate communication (Chien *et al* 2015), help individuals with ASD to understand social situations (Ganz *et al* 2013; Nojavanasghari *et al* 2017), or to help plan responses to complex or unexpected situations (Weikle & Hadadian 2003).

Although these technologies have proved beneficial to many individuals with ASD (Constantin *et al* 2017; Ganz *et al* 2103), individuals with ASD who spend much time on the internet may be at risk of IAD; especially higher-functioning individuals or those with many autism traits who make heavy use of the internet. Indeed, a higher score on the Autism Quotient measure (Baron-Cohen *et al* 2001) is associated with higher levels of problematic internet usage (Romano *et al* 2013). Given this, it might be that considered that, while assistive technologies can be beneficial for many individuals with ASD (Constantin *et al* 2017; Ganz *et al* 2103), their prolonged usage may lead to problems associated with internet addiction.

However, there are considerations that might mitigate the likelihood of individuals with ASD developing IAD. It has been established that the function of the internet use is important in the development of IAD (Weinstein & Lejoyeux 2010; Yang & Brown 2013). Indeed, there are reasons to suppose that the function of internet usage for many people with ASD may differ from that for many who display IAD. For example, people with ASD report using the internet as a favored form of communication that attenuates feelings of isolation and loneliness (Burke *et al* 2010; Mazurek *et al* 2012). This may be especially true of individuals with ASD who are higher-functioning (Pinchevski & Peters 2016). To this extent, these more 'necessitated' social functions of internet usage may mitigate the probability of people with ASD developing IAD.

Thus, although potentially high levels of internet usage predict the development of IAD, the function of internet usage may offer those with ASD protection. The current research aims to explore these issues by investigating whether signs of internet addiction such as withdrawal-like effects (Romano *et al* 2013) are present in individuals from the broad autism phenotype (De Groot & Van Strien 2017) who score highly on autistic traits. This population was investigated: firstly, as a potential model for higher-functioning individuals with ASD; secondly, as focusing on a model population in initial explorations may have ethical advantages over examining this phenomena in individuals with a clinical diagnosis of ASD who may have to rely on assistive technologies to function; thirdly, as AQ has been established as being associated with IAD (Romano *et al* 2013); and fourthly as this population is recognized as of growing importance given their prevalence (De Groot & Van Strien 2017).

To this end, individuals without a clinical diagnosis of ASD were given a battery of psychometric tests, including measures of AQ, IAD, and current mood. They were then allowed exposure to the internet, and then had their mood reassessed. This test has been previously used in the context of experimental testing of withdrawal effects (Romano *et al* 2013), and it has been found that high internet users show a decrease in positive mood following exposure to the internet compared to low internet users. The current study used this procedure, and aimed to investigate whether this effect would replicate in lower AQ scorers, and whether it would, or would not, bee observed in higher AQ scorers.

Material and methods

Participants

One hundred and twenty participants (62 males and 58 female) were recruited. All participants were volunteers, and none received any form of compensation for their participation. Participants has a mean age of 26.10 (±3.04, range 20–33) years old. Their ethnicity was: 84 (70%) White; 7 (6%) Mixed / Multiple Ethnic Groups; 19 (16%) Asian/Asian British; and 10 (8%) Black/African/Caribbean/Black British. Their marital status was: 69 (57%) single, 21 (18%) married/civil partnership, and 30 (25%) in other forms of relationship. Ethical approval for the study was obtained from the Ethics Committee of the Psychology Department of the University.

Materials

Internet Addiction Test (IAT; Young 1998) assesses the degree to which internet use disrupts everyday life, the score ranges from 20 to 100, and a score of 40 or more is taken as representing moderate or worse problematic internet usage. The internal reliability of the scale is 0.93 (Young 1998).

Autistic Spectrum Quotient Questionnaire (AQ; Baron-Cohen *et al* 2001) measures levels of autism traits that an individual lacking an ASD diagnosis may possess. The internal consistency (Cronbach alpha) is 0.82 (Austin 2005; Hurst *et al* 2007).

Positive And Negative Affect Schedule (PANAS; Watson *et al* 1998) measures current positive and negative mood. The internal reliability of both scales is 0.90 (Watson *et al* 1998).

Beck Depression Inventory (BDI; Beck *et al* 1961) assesses symptoms of depression through asking about feelings over the past week. The internal reliability (Cronbach a) of the scale is between 0.73 and 0.92 (Beck *et al* 1988).

Procedure

The participants were seated alone in a quite room and tested individually. They were asked to complete the battery of psychological tests, with the exception of the IAT. The tests were given in random order to the participants, with the exception of the PANAS, which was always completed last. Participants were then allowed access to the internet, through the computer in the room, for 15min. This length of time was chosen on the basis of previous studies of internet withdrawal which have found this value to be long enough to create an effect (Romano *et al* 2013). The contents of the websites that the participants visited were recorded. After 15min, they were asked to complete the PANAS and IAT questionnaires, and were asked some questions about their typical internet usage.

Results

The mean IAT score for the sample was 28.33 (±16.03; range = 4–64); males = 28.94 (±15.92; range = 5–64), and females = 27.69 (±16.25; range = 4–63), $t<1$, $d=0.080$. On the basis of the IAT cut-off for moderate or worse internet problems, 34 (28.3%) of participants had signs of internet problems: 17 (27.4%) males, and 17 (29.3%) females, $\chi^2=0.053$, $p>0.40$.

Table 1 shows the mean scores for the AQ (autism), BDI (depression), IAT (internet addiction), and PANAS (positive and negative mood), as well as the correlations between these scores. Participants' AQ scores correlated with their internet addiction (IAT), depression (BDI), and negative mood (PANAS–), scores. The internet addiction (IAT), and depression (BDI), scores both correlated with negative mood (PANAS–).

The sample was split into lower- and higher-internet problems based on the IAT cut-off score of 40, and in terms of the mean AQ score. This created four groups (with means): low-IAT low-AQ ($N=48$; IAT=15.94; AQ=13.19); low-IAT high AQ ($N=18$; IAT=15.61; AQ=32.89); high-IAT low-AQ ($N=31$; IAT=42.65; AQ=13.42); and high-IAT high-AQ ($N=23$; IAT=44.90; AQ=33.35).

Tab. 1. Mean (standard deviation) scores for internet addiction test (IAT), Autism Quotient (AQ), Beck's Depression Inventory (BDI), and Positive and Negative Affect Scale (PANAS) and the Pearson correlation coefficients between these measures.

	Mean (SD)	AQ	BDI	PANAS+	PANAS–
IAT	28.33 (16.03)	0.221**	0.127	–0.150	0.631***
AQ	20.06 (10.88)		0.277**	–0.136	0.279**
BDI	7.21 (5.88)			–0.002	0.424***
PANAS+	27.54 (6.53)				–0.162
PANAS–	15.83 (5.12)				

*$p<0.05$, **$p<0.01$, ***$p<0.001$

The mean number of websites visited during the 15min period by the participants was 2.22 (±0.94, range = 1–5) for low-IAT groups, and 2.65 (±1.59, range = 1–7) for high-IAT groups. There was no statistically significant difference between the groups, $t(118)=1.79$, $p>0.07$, $d=0.340$. The nature of the sites visited was categorised, and was similar across the two groups: low-IAT = 36% (52) social network; 24% (35) e-mail; 15% (22) games; 12% (17) news and sport; 10% (15) information seeking; and 3% (5) shopping sites; and high-IAT = 43% (64) social network; 23% (34) e-mail; 18% (25) games; 7% (10) news and sport; 5% (7) information seeking; 2% (3) shopping; and 1% (1) banking sites. A chi-squared test revealed no statistically significant difference between the groups, $\chi^2<1$.

Figure 1 shows the mean changes in the positive (PANAS+) and negative (PANAS–) mood scores from before to after internet exposure (PANAS score after minus PANAS score before). There was little change in positive or negative mood for the low-IAT groups, but there was a larger decrease in positive mood for the high-IAT groups irrespective of the AQ score. A two-factor between-subject analyses of covariance (ANCOVA) was conducted on the change data for the positive (PANAS+) mood changes, with AQ (lower versus higher) and IAT (lower versus higher) groups as factors, and depression (BDI) as a covariate. This analysis revealed a statistically significant main effect of IAT group, $F(1,115)=9.60$, $p<0.01$, $\eta^2_p=0.077$, but no main effect of AQ group, $F<1$, $\eta^2_p=0.002$, and no interaction, $F<1$, $\eta^2_p=0.006$. There was little difference in the level of reduction of negative mood for any group. A two-factor ANCOVA (IAT versus AQ)

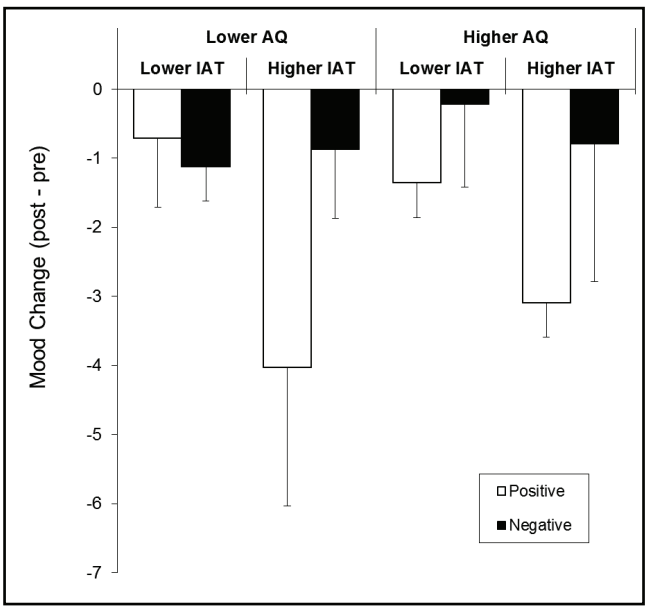

Fig. 1. Group mean changes in mood measured by the PANAS for lower and higher internet problem groups (IAT), and lower and higher autism trait (AQ) groups (bars represent 95% confidence intervals).

with BDI as a covariate revealed no statistically significant main effects of IAT group, $F<1$, $\eta^2_p=0.007$, or AQ group, $F<1$, $\eta^2_p=0.001$, nor an interaction, $F<1$, $\eta^2_p=0.001$.

Discussion

The relationships between the participants AQ and IAT scores replicated those previously observed (Romano *et al* 2013). Additionally, there were positive relationships between problematic internet usage and depression (Gundogar *et al* 2012; Morrison & Gore 2010). Those with higher IAD scores showed decreased positive mood after internet use (Kross *et al* 2013; Romano *et al* 2013). However, there was no indication that this effect was mediated by AQ score. This suggests that those with higher numbers of autism traits are just as likely to experience withdrawal-like effects on stopping using the internet as those with lower AQ scores.

It is not necessarily the case that such results would generalize to a sample with diagnosed ASD; the levels of AQ noted in this study were under those that would be required for a suggestion of high functioning ASD (Baron-Cohen *et al* 2001). It may be that those with high AQ may not use the internet in similar ways to those diagnosed with ASD (Burke *et al* 2010; Mazurek *et al* 2012). However, previous investigations of the relationship between AQ and ASD have suggested that similar effects are found in those with high AQ scores as for those with ASD, even when the score did not reach this cut-off point (Reed *et al* 2011; Stewart *et al* 2009).

A further issue that should be noted is the degree to which a 15min exposure to the internet reflects the types of usage that occur in the 'real world'. This exposure was chosen as it has been shown to produce withdrawal effects previously (Romano *et al* 2013). Moreover, unless individuals are involved in gaming or professional usage, then it may well be that the total time spent on the internet comprises many shorter sessions rather than long sessions. If this were the case, then a 15min exposure may well reflect a typical real-world internet session.

In summary, the current research represents the first attempt to investigate whether internet addiction could be a potential problem in the broad ASD phenotype – a question of some clinical significance, given the high levels of internet usage reported by those individuals and the many assistive-technologies that are employed in the support of individuals with ASD. That high AQ scores did not reduce the possibility of internet withdrawal effects being displayed, and that such withdrawal effects are seen in high internet users leaves open the possibility that computer-based support for people with ASD may solve some problems, while creating some potentially new issues.

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