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## Research Article

# Phoning It in: Social Anxiety, Intolerance of Uncertainty, and Anxiety Reduction Motivations Predict Phone Use in Social Situations

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Based on meta-analysis, a strong link between social anxiety and phone use has been established in the literature, but the underlying mechanisms of why social anxiety might cause people to use their phones are poorly understood. Intolerance of uncertainty is a transdiagnostic factor of many anxiety disorders and may help explain why socially anxious people tend to use their mobile phones as a tool to cope with, or distract from, inherently ambiguous social interactions. This nonexperimental, correlational study had four core aims: to examine whether increases in social anxiety would relate to (1) increased phone usage during social interactions in groups or (2) phone dependency; to examine whether intolerance of uncertainty and motivation of phone use mediated either of these relationships. To test these models, an opportunity sample of 252 participants completed a series of online questionnaires containing measures of social anxiety, intolerance of uncertainty, and phone usage. Correlational analysis of results showed increased phone dependency and phone use in social groups for people with high social anxiety. Serial mediation analysis showed that people who were more socially anxious also reported higher levels of intolerance of uncertainty, greater motives to use phones to reduce anxiety, and higher phone use. We discuss these results with specific reference to compensatory internet use theory. In sum, it appears that for people with social anxiety, phone use in social situations tends to be motivated by reducing anxiety.

## 1. Introduction

Mobile phones are a useful technological tool for modern life. Indeed, they are ubiquitous in social spaces. Yet, some lament their negative effects on face-to-face interactions, and indeed, there is evidence for phones interrupting and reducing the quality and enjoyment of in-person interactions [1, 2]. While in the general population, phone use has been found to have negative implications for social interactions, existing literature has indicated a strong link between social anxiety and phone use with increased social anxiety having a strong, positive correlation with mobile phone addiction [3, 4]. Increased engagement with phones

limits social interactions and increases maladaptive behaviours [5]. Indeed, socially anxious people worry about making mistakes when interacting with others, and this may lead them to avoiding social interactions altogether [6]. For example, they might worry about saying something inappropriate, like swearing loudly in a restaurant, that might cause other people to judge them negatively. To avoid this sort of situation, socially anxious people can use their phone to avoid conversing with others altogether and, therefore, avoid the possibility of making a social faux pas. While previous research has found links between social anxiety and phone use, we expand upon this literature by examining motivations for phone use in social situations. We propose that

phone use during social interaction is a coping strategy for socially anxious people, which serves to ease social discomfort.

In this study, we will examine two possible underlying mechanisms for why social anxiety and phone use might be linked. First, as social interactions are often highly ambiguous [7] (particularly if they involve strangers), we will examine whether someone's ability to tolerate uncertainty mediates the relationship between social anxiety and increased phone usage. Second, we look to see whether the motivation to use one's phone to reduce anxiety in social situations is linked to increased usage. Motivations for usage are important to consider when examining media usage as they can influence rates and types of media usage [8].

Social anxiety is characterized by presentation and performance concerns in social situations [9]. People high in social anxiety worry that they will be unable to make a good impression when meeting new people or are concerned about making social blunders even with people that they know well. Social anxiety occurs on a spectrum with the most severe cases labelled as social anxiety disorder, which might prevent people from leaving their homes and interacting with others, while other people less acutely impacted by social anxiety, display aversive behaviour towards social events but are still able to engage in them [10]. Interestingly, because social anxiety is aversive, people who feel anxious in social situations tend to withdraw in order to cope with their discomfort, to prevent social blunders, and to reduce their anxiety [9]. This may explain why people with social anxiety tend to prefer texting over phone calls [11] because there is less opportunity for making a mistake when they have time to plan what to say ahead of time in a text.

Not only has anxiety been linked to the forms of phone communication people prefer, but it has also been linked to increased phone use [12], problematic phone use [13], and mobile phone addiction [3, 14]. For example, in a study conducted early in the COVID-19 pandemic, researchers found that adolescents who were more anxious tended to engage in more problematic phone use [15]. A compelling experimental study [16] which required participants to turn their phones off or give their phones to the experimenter for an hour found that people who typically used their phone frequently reported increasing levels of anxiety for this imposed period of separation, suggesting some level of addiction to their phones. Existing research also reports a link between increased phone use and depression in American adolescents [17]; people suffering from depression often exhibit symptoms of social anxiety [18]. A recent meta-analysis, combining 254 studies which measured social anxiety and phone addiction found a moderate, positive correlation ( $r = .31$ ) between these variables [3]. Therefore, there is strong evidence for the link between social anxiety and phone use; however, research looking to identify the variables that may mediate and therefore help explain this link is still in its infancy.

Some studies have tested possible mediators between social anxiety and phone use; for example, Zhou et al. [19] found that maladaptive cognition about one's self-worth was a mediator of social anxiety and phone addiction. Addi-

tionally, Kong et al. [20] tested and found support for rumination on past negative events as a mediator of the relationship between social anxiety and problematic phone use. Finally, interpersonal sensitivity or one's concerns about how others will perceive you was a significant mediator between social anxiety and phone addiction [21]. Interestingly, all these mediators are related to the symptoms of social anxiety. For example, people with social anxiety tend to be aware of their lack of social skills which could lead to negative cognitions about one's self-worth [9]. Furthermore, ruminating on past social failures and concerns about impression making are also key features of social anxiety [9]. In the current study, we aim to test a further mediator that is not only associated with social anxiety but also a transdiagnostic symptom associated with a wide range of psychological disorders including depression, obsessive compulsive disorder (OCD), and generalized anxiety disorder (GAD), namely, intolerance of uncertainty [22].

Intolerance of uncertainty (IU) can be defined as "a predisposition to react negatively to an uncertain event or situation, independent of its probability of occurrence and of its associated consequences" (p.934 [23]). In other words, it is a fear, worry, or anxiety about an unknown situation or outcome. People struggling with social anxiety worry about how their self-presentation will be interpreted and how they will behave in social situations [6]. Furthermore, social situations inherently contain ambiguity [7]. While there are norms or rules in social situations about how people should interact, common missteps like verbal interruptions show that these rules do not predict all possible outcomes. Therefore, social situations may be particularly difficult for those with anxiety due to their feelings of IU.

Mobile phones may help people reduce their negative emotions due to IU in two key ways. First, they provide an escape from social interaction which is a key strategy for those with social anxiety to regain control of the interaction and prevent possible presentational mistakes [9]. Looking at a mobile phone screen is a visual cue that one is disengaged from social interaction. This could provide a brief break or distraction from the social interaction if someone is with friends or could prevent an interaction with a stranger from happening. Second, phones can reduce uncertainty through the information they provide. Texting a friend when one feels uncomfortable on a metro full of strangers or looking up directions and ratings of restaurants to choose a place to eat dinner when with friends are all ways that people can reduce uncertainty by using their phones.

Indeed, researchers have found links between IU and mobile phone use. For example, Carleton et al. [24] found a country level, positive correlation, between IU and mobile phone penetration (the percent of people who use mobile phones in a country). Furthermore, nomophobia or the fear of being without one's phone has been linked with IU such that those people who have higher IU are more afraid of being without their phone for any length of time [25]. Finally, in a longitudinal mediation analysis, Rozgonjuk et al. [26] found that IU correlated positively with nonsocial phone use but not social phone use. Nonsocial phone use included activities such as browsing the internet, gaming,

or watching online videos, which might be activities that people engage in when they withdraw from social situations. Therefore, it is to be expected that a low tolerance of uncertainty may be an important predictor of problematic phone usage.

Previous literature has highlighted a link between social anxiety and phone usage [3], where mobile phones may be used to reduce stress arising from ambiguous social interactions; however, increased phone dependency can lead to psychological distress [20]. Furthermore, there is evidence for a bidirectional association between access to mobile phones and anxiety where not having one's phone has been linked to increased anxiety [16], and active use of a phone will lead to decreased anxiety [27]. Uses and Gratification Theory [8] states that considering the motivation behind technology use is key to understanding outcomes related to usage. In this paper, we aim to address a gap in current research by examining the motivation behind mobile phone usage, specifically to decrease anxiety. Furthermore, as already discussed, how tolerant people are towards uncertainty may influence their behaviour in social situations [7]. Thus, a second aim of the current study is to understand how an inability to cope with uncertainty may influence phone usage for socially anxious people in different social interactions. This study will use two serial mediational analyses to assess whether IU and phone use motivations account for the association between SA and phone use in two types of social contexts: socialising with familiar groups and interacting with strangers. We will use two separate statistical models to test our model in each of these social contexts. One model will examine the mediating effects of intolerance of uncertainty and phone use to reduce anxiety in a group between social anxiety and phone use in social groups. A second model will examine the mediating effects of intolerance of uncertainty and phone use to reduce anxiety around strangers between social anxiety and phone dependency.

We hypothesise that social anxiety will be positively correlated with phone use in social groups (H1) and phone dependency (H2). Furthermore, we hypothesise that intolerance of uncertainty and being motivated to use a phone to reduce anxiety in group social situations will serially mediate the relationship between social anxiety and phone use in social groups (H3) and that intolerance of uncertainty and being motivated to use a phone to reduce anxiety around strangers will serially mediate the relationship between social anxiety and phone dependency (H4).

## 2. Method

**2.1. Participants.** An opportunity sample of 252 participants (221 women, 27 men, and 4 nonbinary people) was recruited online. Participants were all smartphone users. Participants were from the UK (35.4%), the United States (18.5%), the European Union (17.8%), and Asia (18.9%), and a small number of participants were from South America, the Middle East, Canada, Australia, and New Zealand. Participants ranged in age from 18 years old to 66 years old ( $M = 27.33$ ,  $SD = 8.70$ ). No financial incentive was offered for participation in this study.

**2.2. Measures and Procedure.** We collected data via an online electronic survey which contained questions in relation to participants' demographic information including age, gender, nationality, and ethnicity. Existing scales were also utilised as measures of social anxiety and intolerance of uncertainty, alongside a phone use questionnaire; these are detailed below. This study was approved by the Northumbria University Ethics Committee.

**2.2.1. Intolerance of Uncertainty (IU).** IU was measured with the 27-item Intolerance of Uncertainty Scale (IUS) originally developed by Freeston et al. [28] in French and later validated in English by Buhr and Dugas [29]. The scale measures participants' discomfort with uncertain situations. For example, one item reads "Unforeseen events upset me greatly." Another item reads, "When I am uncertain, I can't function very well." Items were rated on a 7-point scale (1: strongly disagree, to 7: strongly agree). Higher scores indicate higher levels of intolerance of uncertainty. Although previous studies have found multifactor structures, there is a lack of consistency in the number of factors present in the scale. Therefore, we use mean of the total scale in our analyses and treat it as a single factor (Cronbach's alpha = .943).

**2.2.2. Social Anxiety.** Social anxiety (SA) was measured with 10 items (Cronbach's alpha = .925) based on the symptoms listed in the DSM-V [30]. These symptoms include avoiding social situations due to anxiety, worrying about self-presentation, and having one's relationships negatively affected by social anxiety. An example item is, "I worry what people think about me while in social situations." Items were rated on a 7-point Likert scale (1: strongly disagree, to 7: strongly agree). Higher scores indicate higher levels of social anxiety ( $M = 4.99$ ,  $SD = 1.38$ ).

**2.2.3. Phone Use.** Currently, there is a lack of dedicated measures of phone use unrelated to phone addiction and particularly phone use related to anxiety. Thus, the following items were developed to help answer the research questions in the current study. For all items, a 7-point Likert scale (1: strongly disagree, to 7: strongly agree) was used.

*Phone use motivation to reduce social anxiety (PU-RA).* Two items were used to measure phone use to reduce social anxiety. Item 1 read, "My anxiety eases when I use my phone during social gatherings." Item 2 read, "I tend to worry less if I have my phone in front of me when in social situations." Higher scores indicate stronger agreement that using one's phone in social situations reduces anxiety ( $M = 4.69$ ,  $SD = 1.65$ ). The bivariate correlation between the two items was  $r = .813$  and  $p < .001$ .

*Phone use motivation with strangers (PU-S).* Three items were used to measure phone use to reduce anxiety around strangers. Item 1 read, "I feel more comfortable using my phone when I'm around strangers." Item 2 read, "I like to keep my headphones in while I'm around strangers to ease my anxiety." Item 3 read, "When I'm around strangers, I call someone I know to ease my anxiety." Higher scores indicate stronger agreement that using one's phone when around strangers reduces anxiety ( $M = 4.05$ ,  $SD = 1.40$ , and Cronbach's alpha = .622).

*Phone use in groups (PU-G).* We used one item to measure phone use in group settings, “When I’m in a group setting, I use my phone.” Higher scores indicate higher agreement that participants use their phone when in a group setting ( $M = 5.03$ ,  $SD = 1.58$ ).

*Phone dependency (PU-D).* We used one item to measure nomophobia, “I can’t leave the house without my phone.” Higher scores indicate greater nomophobia ( $M = 5.31$ ,  $SD = 1.91$ ).

**2.3. Statistical Analysis.** We used the Statistical Package for Social Science (SPSS) software, version 27 [31] to analyse the data. Pearson correlation analysis was used to assess the relationship between study variables. This study used the Serial-Multiple Mediation Model 6 [32] in PROCESS for SPSS to estimate the mediation models and test the research hypotheses. See Figure 1 for the theoretical model of SA in association to PU-G through IU and PU-RA (H3), and see Figure 2 for the theoretical model of SA in association with PU-D through IU and PU-S (H4). The recommended 5,000 bootstrap samples were used [33], and alpha was set at .05. In the first model on phone use in groups, we used social anxiety to predict intolerance of uncertainty which in turn predicted phone use to reduce social anxiety in groups, which finally predicted phone use in groups. In the second model, we used social anxiety to predict intolerance of uncertainty which in turn predicted phone use to reduce anxiety with strangers which then predicts phone dependence. The indirect associations were also tested using 95% confidence intervals (CI). In line with Hayes [34], results were considered statistically significant if the CI did not straddle zero. Model fit is evaluated by assessing  $R^2$ . The size of effect was evaluated in each case by utilising Cohen’s [35] benchmarks for effect size. Data can be accessed at <https://osf.io/824fc/>.

### 3. Results

**3.1. Social Anxiety and Phone Usage.** To test the prediction that SA is related to increased phone dependency, and increased phone usage when socialising in groups, a correlational analysis was conducted (see Table 1 for full study correlations). The Pearson product-moment correlation coefficient was computed to assess the relationship between SA and SU-G, and SA and SU-D. Results show that there is a small, significant positive correlation between total scores of SA and SU-G: hypothesis 1 was supported. Increases in SA correlated with increases in phone usage when socialising in groups. Furthermore, there was a small, significant positive correlation between total scores of SA and PU-D. Hypothesis 2 was supported; increases in SA correlated with increased reporting of phone dependency.

#### 3.2. Mediation Models

**3.2.1. Phone Use in Groups.** This model analysed the associations between the following variables: PU-G (outcome), SA (predictor), IUS, and PU-RA (mediators). See Table 2 for the model summary.

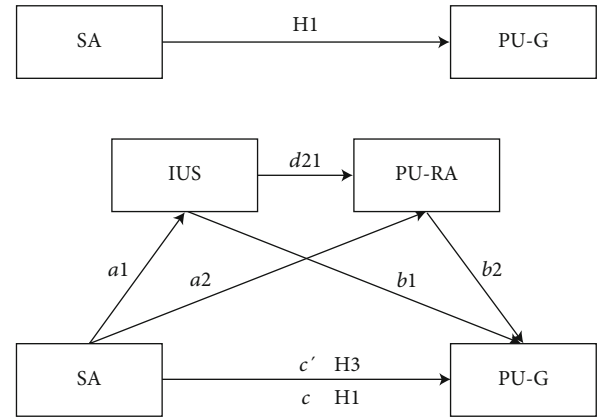


FIGURE 1: Theoretical model of SA on PU-G (H1) and PU-G through IU and PU-RA (H3).

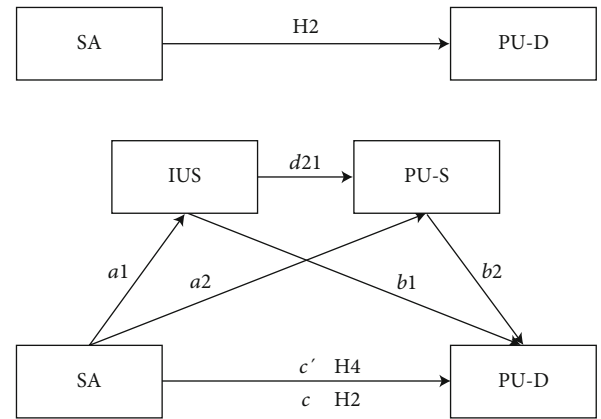


FIGURE 2: Theoretical model of SA on PU-D (H2) and PU-D through IU and PU-S (H4).

TABLE 1: Correlation matrix for each outcome measure.

	1	2	3	4	5	6
1 SA		.67***	.41***	.52***	.31***	.21***
2 IUS			.38***	.56***	.31***	.28***
3 PU-RA				.62***	.64***	.39***
4 PU-S					.53***	.31***
5 PU-G						.43***
6 PU-D						

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ ; two-tailed tests.

Results show that the total effect of SA on PU-G is positive and significant ( $c = .36$ ,  $SE = .07$ ,  $t(250) = 5.18$ ,  $p < .001$ , 95% CI [.22, .49]) indicating that people scoring higher on SA are more likely to use phones in social group settings. The direct effect model of SA on PU-G through IUS and PU-RA was nonsignificant ( $c' = .03$ ,  $SE = .08$ ,  $t(248) = -.39$ ,  $p = .695$ , 95% CI [-.12, .19]) indicating that IUS and PU-RA partially mediated the relationship between SA and PU-G (the regression coefficient reduced and remained statistically significant). Approximately 39% of the variance in phone use in group settings was accounted for by the

TABLE 2: Regression standardized coefficients (Coeff), standard errors (SE), and model summary information for the direct effects of SA on PU-G through IUS and PU-RA.

Antecedent	$M_1$ (IUS)				$M_2$ (PU-RA)				$Y$ (PU-G)			
	Coeff	$T$	SE		Coeff	$T$	SE		Coeff	$T$	SE	
$X$ (SA)	$a_1$	.55***	14.35	.04	$a_2$	.34***	3.65	.09	$c'$	.03	.39	.08
$M_1$ (IUS)	—	—	—	—	$d_{21}$	.29*	2.41	.12	$b_1$	.11	1.03	.10
$M_2$ (PU-RA)	—	—	—	—	—	—	—	—	$b_2$	.56***	10.65	.05
		$R^2 = .45$				$R^2 = .19$				$R^2 = .39$		
		$F(1, 250) = 205.88,$ $p < .001$ ***				$F(2, 249) = 28.19, p <$ .001***				$F(3, 248) = 53.35, p <$ .001***		

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ ; two-tailed tests.

TABLE 3: Regression standardized coefficients (Coeff), standard errors (SE), and model summary information for the direct effects of SA on PU-D through IUS and PU-S.

Antecedent	$M_1$ (IUS)				$M_2$ (PU-S)				$Y$ (PU-D)			
	Coeff	$T$	SE		Coeff	$T$	SE		Coeff	$T$	SE	
$X$ (SA)	$a_1$	.52***	14.35	.04	$a_2$	.26***	3.73	.07	$c'$	-.02	-.15	.12
$M_1$ (IUS)	—	—	—	—	$d_{21}$	.51***	5.55	.09	$b_1$	.28	1.83	.16
$M_2$ (PU-RA)	—	—	—	—	—	—	—	—	$b_2$	.31**	3.05	.10
		$R^2 = .45$				$R^2 = .35$				$R^2 = .11$		
		$F(1, 250) = 205.88, p <$ .001***				$F(2, 249) = 66.16, p <$ .001***				$F(3, 248) = 10.22, p <$ .001***		

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ ; two-tailed tests.

predictors ( $R^2 = .39$ ). The association between SA and PU-G was partially mediated by PU-RA ( $a_2b_2 = .17$ ,  $SE = .05$ , 95% CI [.07, .26]), but the indirect effect of IUS on its own was not significant. In summary, these results partially support the mediational model and show that IUS only mediates the relationship between SA and PU-G if participants report that phone use reduces their anxiety.

**3.2.2. Phone Dependency.** This model analysed the associations between the following variables: PU-D (outcome), SA (predictor), IUS, and PU-S (mediators). See Table 3 for the model summary.

Results show that the total effect of SA on PU-D is positive and significant ( $c = .29$ ,  $SE = .09$ ,  $t(250) = 3.39$ ,  $p < .001$ , 95% CI [.12, .46]) indicating that people scoring higher on SA are more likely to exhibit phone dependency. The direct effect model of SA on PU-D through IUS and PU-S was nonsignificant ( $c' = -.02$ ,  $SE = .12$ ,  $t(248) = -.15$ ,  $p = .88$ , 95% CI [-.24, .21]) indicating that IUS and PU-S fully mediated the relationship between SA and PU-D. Approximately 11% of the variance in phone dependence was accounted for by the predictors ( $R^2 = .11$ ). The association between SA and PU-D was partially mediated by PU-S ( $a_2b_2 = .06$ ,  $SE = .02$ , 95% CI [.01, .11]), but the indirect effect of IUS on its own was not significant. In summary, these results support the predicted mediational model.

## 4. Discussion

In the current study, we investigated the role of two possible mediators in the well-supported relationship between social

anxiety and phone use. Consistent with previous literature [36], we found a direct link between social anxiety and phone use in groups and phone dependency. We also found the hypothesised serial mediation related to phone use in social contexts with known others, such that social anxiety was positively associated with greater IU and increased IU was associated with higher phone use to reduce anxiety in groups which was in turn associated with more phone use in groups. We also found support for our second model concerning phone use in situations with unknown others, such that social anxiety was positively associated with greater IU and increased IU was associated with higher phone use to reduce anxiety around strangers, and this in turn predicted phone dependency. Thus, in both social contexts with known and unknown others, people with social anxiety may turn to their phones to reduce anxiety associated with the uncertainty inherent in social situations.

**4.1. Social Anxiety and Phone Use.** In the current study, we replicated previous work linking social anxiety to increased phone usage [3]. We found that social anxiety was positively associated with both using one's phone in group settings and not being able to leave the house without one's phone; these results support previous findings [36]. Interestingly, existing longitudinal studies have shown that the relationship between social anxiety and phone use does not hold over time [12]. This suggests that social anxiety elicits phone use as a means of coping with acute social anxiety but that this does not become habitual behaviour. Thus, phone use might be a way of reducing acute anxiety in social situations.

For example, researchers have found that parents use their phones while watching their children to decrease boredom during quiet times or search for important information about their children during stressful situations [37].

The behaviours measured in our study could be considered problematic phone use, and these findings pose the question of whether such usage, particularly in groups, has negative consequences for relationships. Interestingly, in a study measuring social anxiety, phone use, and loneliness, loneliness was not correlated with increased phone use although social anxiety was [14].

**4.2. The Importance of considering Motivations of Usage.** In our models, we included both IU and anxiety reduction motivations as mediators of social anxiety and phone use. An interesting finding present in both mediation models is that IU does not directly serve as a mediator between social anxiety and phone use. This is surprising in part because this link has been found in previous literature [26]. Thus, we would have expected to have seen a direct association between IU and increased phone use as a coping strategy. Thus, we might expect that participants experiencing high levels of IU would attempt to alleviate any associated distress through phone use, but we did not find this association.

Instead, we found that the reason behind participants' use was important. Participants need to be motivated to use their phone specifically to decrease anxiety in order for IU to be associated with increased phone use. Our results show that intolerance of uncertainty only predicts phone use when people are motivated to use their phone to decrease their anxiety. This finding is in line with Uses and Gratifications theory [8] which states that people's motivations for using technology will be linked to their type and amount of usage, as well as consequences of their usage. Furthermore, it is congruent with Kardefelt-Winther's theory [38] of compensatory internet use which suggests that people may use technology to alleviate negative emotional states, such as anxiety.

In the current study, we found that phone use with an explicit motivation of reducing anxiety in social situations was linked to more phone use in groups. We also found that phone use with an explicit motivation of reducing anxiety around strangers was positively associated with phone dependency, defined as being unable to leave the home without one's phone. In both cases, people who reported having reduced anxiety when using their phones reported more phone use. This points to the importance of considering the purpose of phone use. If an individual does not see their phone as a tool that can be used to reduce anxiety, then they will be less likely to use it in social situations. On the other hand, if someone does see phone use as a viable method for dealing with their social anxiety, then they might engage in more phone use to reduce this anxiety.

**4.3. Limitations and Future Directions.** The current study used self-report measures of phone use to reduce anxiety and phone use. While these measures may provide insight into the motivations for phone use behaviour, our findings fail to show how these directly influence behavioural out-

comes. This may be problematic, because although people report using their phone to reduce anxiety, we are unable to know whether this motivation directly increases phone usage or leads to reduction in social anxiety over time. Future research would benefit from examining the association between motivation and outcome by conducting both longitudinal repeated assessments of mental health and passive observational data collection to track duration and trends in usage over time to have greater insight into the use of phones as a strategy for reducing social anxiety. However, we would recommend the inclusion of self-report measures of phone use alongside any passive sensing assessments to limit observation effect concerns (i.e., participants alter their pattern of usage as a consequence of knowing that their interactions are being watched) [39].

The participants included in the current study are from an opportunity sample of the general population recruited on social media. This led to an unbalanced sample with more women recruited than men or nonbinary individuals. While this is to be expected because more women use social media than men [40], it means that our results may not necessarily be applicable to men. Future studies should attempt to recruit a larger number of men and nonbinary individuals. Additionally, further studies should look to examine the outcomes of phone use in social situations for those people with acute social anxiety or social anxiety disorder. While some studies show a negative effect of phone use in face-to-face situations [1, 2], these have been conducted in the average population. For those people suffering from social anxiety, phone use during social situations might provide them with an easy method of withdrawing from interaction, and their phone might serve as a comfort object [41] of sorts that allows them to be less anxious when venturing out into the social world. Indeed, phone use specifically related to communicating with others during the stress of the COVID-19 pandemic has been shown to increase well-being [42]. Thus, further investigation on the possible benefits of phone use for socially anxious people needs to be conducted. If phone use does allow socially anxious people, or people simply experiencing anxiety, to be more relaxed in social situations, this could be a relatively easy intervention to suggest for patients suffering from anxiety.

## 5. Conclusion

In the current study, we find continued support for the link between social anxiety and phone use. Our findings also highlight the importance of considering the motivations behind phone use, particularly in social situations. For people with social anxiety, phones may be recruited as a way of reducing anxiety in complex social situations, such as spending time in social groups or socialising with strangers, and thus serve as a motivator for increased phone use. Furthermore, our study has shown that these associations are partially mediated by an inability to tolerate uncertainty. Thus, we identify coping with uncertainty as an additional motivation that contributes to phone overuse beyond those already identified in the literature (namely, rumination,

alleviating boredom, fear of missing out, and emotion regulation [15]). This finding may have implications for the way in which social anxiety and phone addiction interventions are developed, wherein practices which target personal coping with ambiguity may relieve social anxiety and reduce phone usage.

## Data Availability

Data are available on the OSF at <https://osf.io/824fc/>.

## Conflicts of Interest

There are no conflicts of interest to report by the authors.

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## References

- [1] G. Brown, A. M. Manago, and J. E. Trimble, "Tempted to text," *Emerging Adulthood*, vol. 4, no. 6, pp. 440–443, 2016.
- [2] R. J. Dwyer, K. Kushlev, and E. W. Dunn, "Smartphone use undermines enjoyment of face-to-face social interactions," *Journal of Experimental Social Psychology*, vol. 78, pp. 233–239, 2018.
- [3] G. Ran, J. Li, Q. Zhang, and X. Niu, "The association between social anxiety and mobile phone addiction: a three-level meta-analysis," *Computers in Human Behavior*, vol. 130, p. 107198, 2022.
- [4] G. L. Lu, Y. M. Ding, Y. M. Zhang, H. T. Huang, Y. P. Liang, and C. R. Chen, "The correlation between mobile phone addiction and coping style among Chinese adolescents: a meta-analysis," *Child and Adolescent Psychiatry and Mental Health*, vol. 15, no. 1, p. 60, 2021.
- [5] J. Shapka, "Adolescent technology engagement: It is more complicated than a lack of self-control," *Human Behaviour and Emerging Technologies*, vol. 1, no. 2, pp. 103–110, 2019.
- [6] K. Darcy, J. Davila, and J. G. Beck, "Is social anxiety associated with both interpersonal avoidance and interpersonal dependence?," *Cognitive Therapy and Research*, vol. 29, no. 2, pp. 171–186, 2005.
- [7] P. van den Berg and T. Wenseleers, "Uncertainty about social interactions leads to the evolution of social heuristics," *Communications*, vol. 9, no. 1, p. 2151, 2018.
- [8] E. Katz, J. G. Blumler, and M. Gurevitch, "Uses and gratifications research," *The Public Opinion Quarterly*, vol. 37, no. 4, pp. 509–523, 1974.
- [9] M. R. Leary and K. P. Jongman-Sereno, "Social anxiety as an early warning system: a refinement and extension of the self-presentation theory of social anxiety," in *In Social Anxiety*, pp. 579–597, Academic Press, 2014.
- [10] M. R. Liebowitz, "Social phobia," *Modern Problems in Pharmacopsychiatry*, vol. 22, pp. 141–173, 1987.
- [11] D. J. Reid and F. J. Reid, "Text or talk? Social anxiety, loneliness, and divergent preferences for cell phone use," *Cyberpsychology & Behavior*, vol. 10, no. 3, pp. 424–435, 2007.
- [12] S. M. Coyne, L. Stockdale, and K. Summers, "Problematic cell phone use, depression, anxiety, and self-regulation: evidence from a three year longitudinal study from adolescence to emerging adulthood," *Computers in Human Behavior*, vol. 96, pp. 78–84, 2019.
- [13] W. Hong, R. D. Liu, T. P. Oei, R. Zhen, S. Jiang, and X. Sheng, "The mediating and moderating roles of social anxiety and relatedness need satisfaction on the relationship between shyness and problematic mobile phone use among adolescents," *Computers in Human Behavior*, vol. 93, pp. 301–308, 2019.
- [14] A. Enez Darcin, S. Kose, C. O. Noyan, S. Nurmedov, O. Yilmaz, and N. Dilbaz, "Smartphone addiction and its relationship with social anxiety and loneliness," *Behaviour & Information Technology*, vol. 35, no. 7, pp. 520–525, 2016.
- [15] C. J. Hallauer, E. A. Rooney, H. Yang, Q. Meng, C. Montag, and J. D. Elhai, "Anxiety sensitivity mediates relations between anxiety (but not depression) and problematic smartphone use severity, adjusting for age and sex, in Chinese adolescents early in the COVID-19 pandemic," *Human Behaviour and Emerging Technologies*, vol. 3, no. 5, pp. 788–797, 2021.
- [16] N. Cheever, L. Rosen, L. Carrier, and A. Chavez, "Out of sight is not out of mind: the impact of restricting wireless mobile device use on anxiety levels among low, moderate and high users," *Computers in Human Behaviour*, vol. 37, pp. 290–297, 2014.
- [17] J. M. Twenge, T. E. Joiner, M. L. Rogers, and G. N. Martin, "Increases in depressive symptoms, suicide-related outcomes, and suicide rates among U.S. adolescents after 2010 and links to increased new media screen time," *Clinical Psychological Science*, vol. 6, no. 1, pp. 3–17, 2018.
- [18] L. A. Clark and D. Watson, "Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications," *Journal of Abnormal Psychology*, vol. 100, no. 3, pp. 316–336, 1991.
- [19] H. L. Zhou, H. B. Jiang, B. Zhang, and H. Y. Liang, "Social anxiety, maladaptive cognition, mobile phone addiction, and perceived social support: a moderated mediation model," *Journal of Psychology in Africa*, vol. 31, no. 3, pp. 248–253, 2021.
- [20] F. Kong, J. Qin, B. Huang, H. Zhang, and L. Lei, "The effect of social anxiety on mobile phone dependence among Chinese adolescents: a moderated mediation model," *Children and Youth Services Review*, vol. 108, article 104517, 2020.
- [21] Z. You, Y. Zhang, L. Zhang, Y. Xu, and X. Chen, "How does self-esteem affect mobile phone addiction? The mediating role of social anxiety and interpersonal sensitivity," *Psychiatry Research*, vol. 271, pp. 526–531, 2019.
- [22] R. N. Carleton, M. K. Mulvogue, M. A. Thibodeau, R. E. McCabe, M. M. Antony, and G. J. Asmundson, "Increasingly certain about uncertainty: intolerance of uncertainty across anxiety and depression," *Journal of Anxiety Disorders*, vol. 26, no. 3, pp. 468–479, 2012.
- [23] R. Ladouceur, P. Gosselin, and M. J. Dugas, "Experimental manipulation of intolerance of uncertainty: a study of a theoretical model of worry," *Behaviour Research and Therapy*, vol. 38, no. 9, pp. 933–941, 2000.
- [24] R. N. Carleton, G. Desgagné, R. Krakauer, and R. Y. Hong, "Increasing intolerance of uncertainty over time: the potential influence of increasing connectivity," *Cognitive Behaviour Therapy*, vol. 48, no. 2, pp. 121–136, 2019.
- [25] M. Ercengiz, B. Yildiz, M. Savci, and M. D. Griffiths, "Differentiation of self, emotion management skills, and nomophobia among smartphone users: the mediating and moderating roles of intolerance of uncertainty," *The Social Science Journal*, vol. 1-15, pp. 1–15, 2020.



- [26] D. Rozgonjuk, J. D. Elhai, K. Täht, K. Vassil, J. C. Levine, and G. J. Asmundson, "Non-social smartphone use mediates the relationship between intolerance of uncertainty and problematic smartphone use: evidence from a repeated-measures study," *Computers in Human Behavior*, vol. 96, pp. 56–62, 2019.
- [27] J. D. Elhai, O. Sapci, H. Yang, A. Amialchuk, D. Rozgonjuk, and C. Montag, "Objectively-measured and self-reported smartphone use in relation to surface learning, procrastination, academic productivity, and psychopathology symptoms in college students," *Human Behaviour and Emerging Technologies*, vol. 3, no. 5, pp. 912–921, 2021.
- [28] M. H. Freeston, J. Rhéaume, H. Letarte, M. J. Dugas, and R. Ladouceur, "Why do people worry?," *Personality and Individual Differences*, vol. 17, no. 6, pp. 791–802, 1994.
- [29] K. Buhr and M. J. Dugas, "The intolerance of uncertainty scale: psychometric properties of the English version," *Behaviour Research and Therapy*, vol. 40, no. 8, pp. 931–945, 2002.
- [30] American Psychiatric Association, *Anxiety disorders. In Diagnostic and Statistical Manual of Mental Disorders*, APS, 5th edition, 2013.
- [31] I. B. M. Corp, *IBM SPSS Statistics for Windows, Version 27.0*, IBM Corp, Armonk, NY, 2020.
- [32] A. F. Hayes, *PROCESS: a versatile computational tool for observed variable mediation, moderation, and conditional process modeling*, 2012, <http://www.afhayes.com/>.
- [33] K. J. Preacher and A. F. Hayes, "SPSS and SAS procedures for estimating indirect effects in simple mediation models," *Behavior Research Methods, Instruments & Computers*, vol. 36, no. 4, pp. 717–731, 2004.
- [34] A. F. Hayes, *Introduction to Mediation, Moderation, and Conditional Process Analysis: a Regression-Based Approach*, Guilford Press, 2013.
- [35] J. Cohen, *Statistical Power Analysis for the Behavioral Sciences*, Lawrence Erlbaum Associates, Publishers, Hillsdale, NJ, 2nd edition, 1988.
- [36] A. Kaur, A. Ani, A. Sharma, and V. Kumari, "Nomophobia and social interaction anxiety among university students," *International Journal of Africa Nursing Sciences*, vol. 15, p. 100352, 2021.
- [37] L. Wolfers, "Parental mobile media use for coping with stress: a focus groups study," *Human Behaviour and Emerging Technologies*, vol. 3, no. 2, pp. 304–315, 2021.
- [38] D. Kardefelt-Winther, "A conceptual and methodological critique of internet addiction research: towards a model of compensatory internet use," *Computers in Human Behavior*, vol. 31, pp. 351–354, 2014.
- [39] E.-M. Messner, R. Sariyska, B. Mayer et al., "Insights – future implications of passive smartphone sensing in the therapeutic context," *Verhaltenstherapie*, pp. 1–10, 2019.
- [40] A. Perrin, "Social media usage," *Pew Research Centre*, vol. 125, pp. 52–68, 2015.
- [41] R. Ribak, "Remote control, umbilical cord and beyond: the mobile phone as a transitional object," *British Journal of Developmental Psychology*, vol. 27, no. 1, pp. 183–196, 2009.
- [42] G. Brown and P. Greenfield, "Staying connected during stay-at-home: communication with family and friends and its association with well-being," *Human Behaviour and Emerging Technologies*, vol. 3, no. 1, pp. 147–156, 2021.