**ORIGINAL ARTICLE**

# Procrastination on social media: predictors of types, triggers and acceptance of countermeasures

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## Abstract

Procrastination refers to the voluntary delay of urgent tasks and can have several negative consequences such as stress, health issues and academic under-achievement. Several factors including personality, culture and gender have been identified as predictors of procrastination, although there are some conflicting findings within the literature. Social networking sites have been identified as a possible facilitator of procrastination, in part due to their design features that encourage immersion and continual interaction. However, social networking sites also provide the opportunity for intelligent, real-time prevention and intervention strategies to be delivered that can reduce the experience of procrastination. In this paper, we build upon our research in which we used a mixed-method approach to explore the types, triggers and acceptance of countermeasures for procrastination on social media. Following a survey of 288 participants from the UK ($n = 165$) and the Kingdom of Saudi Arabia ($n = 123$), we conducted a series of multiple regression and binary logistic regression models to determine predictors of these factors. Several predictors such as self-control and conscientiousness were found to be significant predictors, but overall, the amount of variance explained by the regression models was relatively low. The results demonstrate that participants are receptive to countermeasures for procrastination being delivered through social networking sites but suggest that the predictors of procrastination related phenomena experienced in social networking sites are different than in offline settings.

**Keywords** Procrastination · Social networking sites · Design · Countermeasures prevention

## 1 Background

Procrastination has been described as the voluntary delay of urgent tasks, which may result in negative consequences (Klingsieck 2013), such as higher stress and poor health (Tice and Baumeister 1997; Sirois et al. 2003). It is viewed within psychological research as a self-regulation failure (van Eerde and Klingsieck 2018). Self-regulation refers to our ability to make use of our cognitive, emotional and behavioural resources to achieve a goal or outcome (Baumeister and Heatherton 1996). Procrastination is a phenomenon that has been argued as being especially relevant in student populations (van Eerde and Klingsieck 2018), where it has been shown it can have severe consequences on academic achievement (Kim and Seo 2015).

Procrastination may be exacerbated by technologies such as social media and smartphones (Rozgonjuk, Kattago and Täht 2018). This possibility was first raised in early research into the internet, where it was found that people who perceive the internet as enjoyable are more likely to report higher levels of online procrastination (Lavoie and Pychyl 2001). There are several forms of procrastination in the context of SNSs, such as cyberslacking and personal web usage. Cyberslacking is defining as an employee who uses the Internet for a non-work related task during working hours (Bock and Ho 2009). It can create various issues for the employee related to work performance and can also disrupt the work environment (O'Neill, Hambley and Bercovich 2014). In academia, cyberslacking behaviour affects the students' educational performance and damages their cognitive and retention abilities, mainly due to the surfing of unrelated digital media during class time (McKeachie & Svinicki 2013).

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Personal web usage is any voluntary act of using the Internet for personal use during working hours such as gambling, online shopping, or news surfing, which can cause procrastination, time wasting, and reduce work quality and productivity (Coker 2013).

If online technologies do increase procrastination, then this is a matter of concern, especially in relation to young adult and student populations. There has been an increase in the amount of time that young adults spend online, with 16–24 year olds in the UK spending on average 27 h a week online in 2018; three times the amount than a decade before (OFCOM 2018). In students this behaviour may overlap with offline activities and commitments, with research suggesting that most students spend up to 40% of their time in class on social media (Ravizza et al, 2016). The need for students to balance social networking site (SNS) use with their academic studies has been identified as a new form of the classic self-control dilemma, defined as competition between an immediate low priority impulse and a distal high priority goal (Reinecke and Hofmann 2016). Indeed, using social media at the cost of performing goal related activities has been argued to be a specific type of procrastination (Meier et al 2016). It is possible that there are unique characteristics of SNS related procrastination. For example, it has been noted that procrastination facilitated through Facebook appears to be associated with increased anxiety on the part of the procrastinator (Sternberg et al, 2020).

Alblwi (2020) have discuss several psychological theories related to behavioural change that can be used to reason about the factors that contribute towards procrastination. As they note self-determination theory (SDT) focuses on human motivation and personality, addressing people's inherent growth tendencies, innate, and psychological needs, which are formed by combining cognitive evaluation theory and organismic integration theory (OIT) (Ryan and Deci 2000). SDT identifies motivational factors that trigger people to make certain choices without an external stimulus and interference. Cognitive evaluation theory explains the effects of external factors on internal motivation. It addresses the common psychological health needs, including competence, autonomy, and relatedness, which are essential to gain intrinsic and extrinsic motivation based on getting rewards or outcomes inherent in the task. For example, people may use SNS for entertainment or gaining popularity by trying to increase their social circle. On the other hand, OIT theory discusses the different types of motivations which can regulate behaviour. OIT defines six types of regulations (amotivation, external, introjected, identified regulation, integrated, intrinsic) that vary according to the amount of autonomy available to the participant and the motivational value of the activity, to them (Ryan and Deci 2000). For example, a person driven by external regulation may be motivated to satisfy an external demand and always maintains a good

relationship with their peers. This could result increased SNS use.

Research has identified several individual factors that relate to procrastination. Özer et al. (2009) found that over half of their sample of 784 participants self-reported frequent academic procrastination, with male students reporting much more frequent procrastination than female students. There were also reported differences in why females and males procrastinate. Female students reported procrastinating more because of their fear of failure and fear of appearing lazy. Males, on the other hand, reported procrastination because of taking risks and rebelling against control. Kaya et al. (2012) replicated this finding, observing that female students were able to manage time better than male students. It was also found that the time management skills of the students decreased as their anxiety level increased. Steel et al. (2001) conducted a meta-analysis of the association between personality traits and procrastination. The results of the review suggested a weak connection between neuroticism, rebelliousness and sensation seeking. Strong and consistent predictors of procrastination were task aversiveness, task delay, self-efficacy, and impulsiveness, as well as conscientiousness and its facets of self-control, distractibility, organisation and achievement motivation. It has also been observed that procrastination shares many features with the Dark Triad of personality (narcissism, Machiavellianism and psychopathy), such as high impulsivity and low conscientiousness (Lyons and Rice 2014). In contrast to studies linking procrastination to anxiety Martincekova and Enright (2020) found no relationship between procrastination and individuals' proneness to guilt. Overall, the research literature on individual predictors of procrastination is varied, and as commented on elsewhere (van Eerde and Klingsieck 2018), lacks consistency.

It has been argued that procrastination also varies between cultures (Triandis 1989; Eskin 2003; Nair 2017). Beswick et al. (1988) for example found that Asian students, compared to Western students, scored higher on hypervigilance (a panicky style of decision making) and procrastination (avoidant styles of decision making). This phenomenon was further analysed by Klassen et al. (2010) across Canadian and Singaporean students. Singaporean students were more likely to be negative procrastinators and spent more time procrastinating than Canadian students and were also found to demonstrate lower self-regulation and self-efficacy. This would appear to be consistent with the cultural dimensions of each country, as reported by Hofstede Insights (2020), which is based on original research conducted by Hofstede et al. (2010). Under these ratings, Singapore is reported to be a markedly more collectivistic culture than Canada, which means that individuals are more reluctant to take individual actions that could result in a negative outcome (for example failing an exam), and in turn more likely to use

procrastination as an avoidance strategy. Conversely Singapore is rated by Hofstede Insights (2020) as having a lower level of uncertainty avoidance than Canada, which could result in feelings of less pressure to plan and complete tasks on time. This also supports the work of Beswick et al (1988) who found that Asian students procrastinate more than Western students in university settings. It must be acknowledged that models of cultural dimensions have been criticised for being overly simplistic (Vignoles et al. 2016), and as such caution should be taken when interpreting the research literature on this topic.

Interventions have been proposed to reduce procrastination. In a meta-analysis of studies van Eerde and Klingsieck (2018) identify several therapeutic techniques that appear to be effective, with cognitive behavioural therapy being the most effective. Therapeutic approaches of this type are typically time and resource intensive and require one to one communication between the therapist and the patient, often done in-person. However, whilst SNS and related technologies may contribute towards procrastination, they can also be used to deliver countermeasures. This is because the technologies allow for real time, intelligent, data driven prevention and intervention strategies to be delivered, including the use of gamification (Alblwi et al. 2019a). This has been explored in relation to other online behaviours including digital addiction (Alrobai et al. 2019) and fear of missing out (Alutaybi et al. 2019a, b). It contrasts with traditional methods of prevention and intervention campaigns used within social psychology and behaviour change research. These traditional approaches rely on mass media campaigns and other related approaches to present information to the target population in a one-sided manner (Caraban et al. 2019).

In addition to therapeutic interventions, recently, different design techniques have been suggested to reduce procrastination. Redesigning websites by removing extra distracting content, visualising the usage time and rewarding self-control related behaviour are a few of these techniques discussed in HCI research to reduce time spent in procrastinating and support productivity (Lyngs et al. 2019; Lyngs et al. 2019). Design interventions in social media, such as hiding likes count (Grosser 2019), removing news feed and setting goal reminders (Kovacs et al. 2019; Lyngs et al. 2020), have been examined. Blocking continuous online news feed has been shown to reduce the time spent on social media, especially with individuals who are more vulnerable to social media distractions (Mark et al. 2018). While several researchers have examined removing or blocking content, others investigated adding a visual cue to boost productivity and reduce interruption time. Liu et al. (2014) presented users with a visual representation of the time spent when a task is interrupted. Compared to the control group, the subject presented with this visual cue spent less time procrastinating and completed the job more efficiently. Persuasive design

techniques have been used as countermeasures. Foulonneau et al. (2016) used context-aware persuasive messages to limit users' screen time. Despite the power that persuasive techniques and gamification tools have on altering human behaviour, they are rarely adapted in this context (Lukas and Berking 2018).

The data produced by SNS also provides opportunities for a deeper understanding of how procrastination is created and viewed, such as the attitudes towards procrastination identified in large scale sentiment analysis of social media posts by Chen et al. (2020). Appropriate use of SNS technologies may facilitate the application of techniques developed in other domains to reduce rates of other problematic behaviour by increasing knowledge and shifting decision making. For example, it been suggested that one reason students procrastinate is due of their lack of awareness on how to schedule time properly (Nair 2017). Using intelligent, real-time systems that delivers advice based on the SNS behaviour of that individual and steers them towards effective time management may prevent them from developing problematic procrastination in the first place. This is consistent with the nudge approach to behaviour change (Thaler and Sunstein 2009), which is increasingly used in conjunction with technology to address health and wellbeing issues (Caraban et al. 2019). It should be noted that it is within the realm of the designers of SNS to embed such techniques. As we observe in our research SNS are already set-up in ways that encourage immersion (Alutaybi et al. 2019a, b). There is potential for the same techniques and systems to be used to reduce SNS facilitated procrastination.

To do so we need to first understand how social media may trigger different types of procrastination and what countermeasures could be implemented that would be acceptable to users of these systems. In previous research, (Alblwi et al. 2019a, 2019b, 2020), we identified different types of procrastination and SNS features which may trigger it. The work also identified technical countermeasures that can be integrated to social media design to help users have more control over their procrastination. In this paper, we study predictors of the types of procrastination and the acceptance of these countermeasures. The predictors include gender, culture, self-control, number of procrastination hours per day, personality traits and the types of procrastination participants declared themselves to experience.

## 2 Methodology

A two-phase study was conducted that consisted of an initial qualitative phase followed by a quantitative phase. This approach is consistent with the model of generalisation, as identified by Mayring (2007). The approach was chosen due to the lack of research literature on social media facilitated

procrastination. As noted in the previous section, the role of social media in the experience of procrastination remains relatively unexplored, with potential countermeasures being largely based on research on procrastination in other domains and mainly concerned with time management tools neglecting the new elements social media add such as the continuous peer pressure, notifications, immersive designs, and personalised content. Similarly, there is a lack of theoretical understanding of procrastination in relation to social media. The mixed methods approach has been argued to contribute towards theory (Coxon, 2005). We adopted an exploratory sequential mixed methods approach (Creswell and Plano Clark 2017) where the initial qualitative data collection and analysis was used to develop a deeper understanding of the phenomenon as experienced by participants and provide a basis for the quantitative part that was meant for confirming the findings, discovering trends and inferring prediction relations amongst procrastination components. Data were gathered in the qualitative phase through two stages, an exploration stage followed by a co-design stage. Data were then gathered in the quantitative phase through use of an online survey, which sought to determine how the factors identified in the qualitative phase could be applied to a larger population. As part of quantitative phase regression analysis was used to identify which variables are predictive of procrastination and acceptance of procrastination countermeasures. The phases were conducted in sequence, meaning that the findings from the qualitative phase informed those of the quantitative phase. The materials used in these phases can be found at https://eprints.bournemouth.ac.uk/34402/.

## 2.1 Qualitative phase: exploration of procrastinaiton types and SNS features acting as procrastionation triggers

Several qualitative data collection activities were undertaken: two focus groups, a diary study and clarification interviews. The focus groups consisted of 16 participants (nine female/ seven male) aged between 18 and 40 years, all of whom were self-declared frequent procrastinators on SNS. The focus group stage provided information on how procrastination occurs on SNSs, and it highlighted specific features of SNS that may facilitate procrastination. Throughout the focus groups, participants were presented with various scenarios to identify the general way in which procrastination happens. This explanation was also intended to provide theoretical background for the research, and it was expected that the use of scenarios would increase participant engagement. The scenarios were based on psychological theories such as self-esteem and self-efficacy (Bandura 1977; Baumeister et al. 2005).

The diary study activity was conducted for a 10-day period to gather information from the same participants about their lived experience of procrastination on SNS accounts in a real-world setting. This was done to determine the ecological validity of the focus group findings, an approach that has been used in other research studies (Fraley and Hudson 2014). Additionally, the diary study provided additional information that clarified the features of SNS that may facilitates procrastination. Follow-up interviews were then conducted with three participants after the diary study to further clarify the data wherever necessary. This served as a form of member checking, the purpose of which is to improve the trustworthiness of non-statistical data by ensuring that the data captured reflects what each participant intended to say (Mayer et al. 1999; Sirois and Pychyl 2013).

Finally, thematic analysis was undertaken to detect, examine and report on recurring patterns in the collected data. In turn, these recurring patterns were organised as themes and findings. The stages of thematic analysis involved in this part of the study were those recommended by Braun and Clarke (2006), and the findings from this phase are available in Alblwi et al. (2019b). Thematic analysis has been found to be an appropriate choice of qualitative analysis when conducting exploratory studies in under-researched areas (Braun and Clark 2006).

## 2.2 Qualitative phase: co-design of new SNS features to introduce as procrastionation countermeasures.

Two design sessions were undertaken with 14 participants (six female/ eight male) aged between 18 and 40. Of these 14 participants, six participants had previously participated in the exploration phase of the qualitative part of the study. The purpose of these design sessions was to identify the countermeasures that can be applied to mitigate procrastination on SNS. The inclusion criteria from the exploration phase were used, meaning all the participants were individuals who had self-reported on their high level of procrastination on SNSs.

Co-design refers to an approach in which end-users are empowered throughout the design process, which increases their likelihood of accepting the final product (Payne, Storbacka and Frow 2008). Co-design allows designers to understand end-users, which accounts for the level of acceptance for the proposed design (Song and Adams 1993). Supporting materials for the co-design sessions were based on the exploration stage findings. Scenarios were established based on standard procrastination patterns, and cards were prepared to represent specific features of SNSs that were previously identified as triggers of procrastination. Working with the participants, the researcher conceptualised countermeasures for procrastination, and none of the participants were restricted in terms of what they could suggest. A range of modalities relating to the question of how to apply

specific anti-procrastination systems (e.g. in a proactive or reflective way) was also discussed. The co-design sessions followed the recommendations and steps suggested by Cruickshank, Coupe and Hennessy (2016) and Schuler and Namioka (1993). This phase's findings are available in Alblwi et al. (2019a)

## 2.3 Quantitative phase: confirmation

The purpose of this phase was to examine the findings from the qualitative phase with a larger population. An online survey was distributed to the email addresses of both UK and KSA students, and promotional materials (e.g. posters and leaflets) were disseminated to raise awareness on the campuses of both institutions. A QR code was used as the mechanism for providing access to the questionnaire for participants.

A total of 334 participants, 147 (44%) of whom were female and all of whom were aged between 18 and 67 years (mean = 27 years Std: 7.3), completed the questionnaire. Individuals from the UK formed the largest demographic group ($n = 165$, 49%), while 123 (37%) were from the KSA, and 48 (14%) were from neither the UK nor the KSA. The inclusion criteria were that participants must have a minimum of one active SNS account and must also describe themselves as SNS procrastinators. Descriptive results from the survey are available in Alblwi et al. (2020). The results in this paper focus on the inferential analysis of the quantitative data and how it relates to the qualitative findings.

## 3 Qualitative findings

In the following subsections, we briefly present the procrastination types which were identified during the qualitative phase of the study, which are published in Alblwi et al. (2019b). We then present the SNS features that were identified to trigger procrastination in Alblwi et al. (2019b) and, also, the suggested countermeasures for each of these SNS features. The whole set of suggested countermeasures can be found in Alblwi et al (2019a) and the

pairing between these countermeasures and SNS features can be found in Alblwi et al. (2020).

### 3.1 Procrastination on SNS: types

Through the thematic analysis of the data collected in the first qualitative phase, consisting of two focus groups and a 10 days diary study with 16 participants and three follow-up interviews (see Sect. 2.1 and Appendices 1, 2 and 3 of Alblwi 2020, we identified four types of procrastination Alblwi et al (2019b),:

- **Avoidance**: This refers to the act of staying away from something or refraining from doing it. In procrastination, motivation to avoid a particular act or task may arise from the sense of displeasure at the thought of doing it, which causes the start of the work to be delayed (Ferrari et al. 2005).
- **Escapism**: This refers to an individual's sense that they must distance themselves from the real-world and "escape" from it (i.e. through the use of SNSs). In some cases, escapism arises from financial pressures, while in other cases, it arises from loneliness or mental illness. Escapism often causes people to seek out the virtual environments offered by SNSs (Warmelink et al. 2009).
- **Emergence**: This type of procrastination occurs when an individual who is focusing on another task becomes distracted by an SNS task, which then triggers online procrastination. The emerged task can lead people to lose focus on delay the work associated with their initial task. As such, their productivity is undermined (Mark et al. 2015). Given the continuous nature of SNSs as mediums from communication, distraction is a constant threat.
- **Mood modification**: Procrastination is often pursued for its mood-altering effects, and it can serve as a powerful coping strategy (Griffiths et al. 2014). Such procrastination occurs when an individual uses an SNS to change their mood rather than to complete specific tasks.

The procrastination types identified in this phase of the study were used as the basis for questions asked in the quantitative survey, with participants asked to rate how strongly they agreed that each item applied to themselves. The pairing between each of the procrastination types

**Table 1** Types of procrastination on SNS

| Procrastination types | Questions in the survey |
|---|---|
| Avoidance type | I often procrastinate to avoid working on unpleasant or difficult tasks |
| Mood modification type | I often procrastinate to change my mood and feel better |
| Escapism type | I often procrastinate to distance myself from real-life issues |
| Emergence type | When I receive a notification, I check it and spend time on that despite having other tasks to perform |

derived from the qualitative phase and the corresponding question used to in the quantitative survey is shown in Table 1.

## 3.2 SNS features and their related countermeasures

As described earlier in the methodology section, we conducted two further co-design sessions with 14 participants, in which we identified countermeasures that could be used to minimise the effects of the SNS features that trigger procrastination. The study followed recommendations suggested in Cruickshank, Coupe and Hennessy (2016) and Schuler and Namioka (1993) and we described it in Sect. 2.2. Further details about the material used and the co-design sessions can be found in the Appendix 4 of Alblwi 2020. Samples of the co-design artefact can be also seen in Alblwi et al (2020). Within the quantitative survey, participants were asked to indicate i) their level of agreement to how much each trigger applies to them and ii) their acceptance of each corresponding proposed countermeasure. The pairing of the triggers to the countermeasures is shown in Table 2, along with the question that was used in the survey to measure the level of agreement/acceptance to that trigger. A brief description of each countermeasure and how this relates to triggers is given in the sections that follow. A fuller discussion of each of these is given in Alblwi et al (2020).

### 3.2.1 Notification features and their countermeasures

Notification features improve connectivity by alerting users after interactions with specific services (Dawot and Ibrahim 2014). The two modalities of these features that can be triggers for procrastination are deactivated notifications and activated notifications. In the case of the deactivated notification, the user is persuaded to procrastinate in an indirect way. This is because they have a greater temptation to know whether they received messages when a notification was muted, which triggers curiosity to engage with the SNS. As such, when the user browses SNSs, they are likely to compensate and perform other activities (e.g. entering a conversation or searching for specific data). Contrastingly, activated notifications directly trigger procrastination. Clicking on an activated notification will lead to SNS access, after which other related activities may be engaged in.

In the co-design sessions held in this study, various countermeasures were proposed by the participants as viable ways to address the procrastination triggered by notification features. These countermeasures include showing the user's availability, receiving suggestions and an auto-reply function. In the case of showing the user's availability, this could manage the expectations of other individuals in the user's social network, which could reduce the pressure they feel to check and respond to notifications. Additionally,

receiving suggestions about how to avoid procrastination (e.g. by muting notifications) was identified as valuable by the participants. Finally, auto-reply was proposed as another way to manage others' expectations, since it allows others to confirm the user's availability and check when they are likely to receive a response.

### 3.2.2 Immersive design features and their countermeasures

Immersive design features influence users to remain within a system for an extended period time due to the fear of missing temporal content (e.g. stories on Snapchat). Features of SNSs such as endless feeds can trigger procrastination because users are likely to continue viewing the endless stream of new posts. Additionally, the pull-to-refresh feature is intended to provide a continuous reminder to users of the endless nature of newsfeeds. As a case in point, when a user updates their Twitter newsfeed, the pull-to-refresh icon appears, which increases the expectation of seeing something new, even when nothing new emerges. The feature has been identified as a way to increase interaction times with SNSs. The customised content feature also provides content based on a user's preferences, as proxies by their browsing profile. This also takes place by providing links or alternative content linked to the content that a user is viewing at a given time (i.e. through recommender systems). Therefore, alternative content may trigger the user's interest, thereby extending total interaction times.

The co-design sessions highlighted the following three strategies for combatting procrastination triggered by immersive design features: firstly, usage feedback; secondly, usage reminders; and finally, time restriction techniques. Regarding usage feedback, the participants emphasised that continuous monitoring of a user's level of usage, as well as sending them reminders, alerts and feedback about their usage, could remove a factor that triggers procrastination. Additionally, reminder countermeasures could be personalised to specific users (e.g. in terms of the time when it is received), and feedback about procrastination, if it is person-specific could assist users in identifying and resolving the main issues that lead to their procrastination. Although some users may still have difficulties in managing their time after encountering usage feedback and usage reminder mechanisms, time restriction techniques could solve this problem. For example, with time restriction functionality, users could deliberately limit the amount of time they have on SNSs (e.g. by linking the SNS with scheduling data from an online calendar website or another application).

**Table 2** SNS features as procrastination triggers vs. countermeasures to add to SNS to mitigate their effect

| SNS Features as Procrastination Triggers | Survey item | Countermeasures | Survey item |
|---|---|---|---|
| Notification features | I often delay working on my tasks because I am busy checking notifications on social media | Auto-reply | Auto-reply; e.g. sending an auto-reply that contains some information such as I received your message, I will read and reply later when finishing my current work |
| | | Showing availability | Showing availability; e.g. when you receive notification, your contacts will be automatically informed that you are unavailable or busy |
| | | Suggestions | Suggestions; e.g. at the same time as the notification you receive a message suggesting how to avoid procrastination, e.g. showing how to mute notification and how to declare a Busy status |
| Immersive design features | On social media, I spend time more than I initially intended due to seeing relevant content suggested to me automatically | Time restriction | Time restriction; e.g. restricting you from using social media beyond a maximum time or during certain hours of the day that you sat for yourself |
| | | Usage reminder | Usage reminder; e.g. when you decide to spend 30 min on social media, you receive a reminder about the time that you have spent once you approach or exceed that limit |
| | | Usage feedback | Usage feedback; e.g. at the end of the day, you can see statistics regarding the time you spent on social media and when such a usage conflicted with your other tasks listed in your online calendar |
| Surveillance of presence features | When I send a message to someone, I keep checking whether or not they received, read or replied my message | Auto-reply | Receiving an automated message from your contacts containing information such as I am currently busy and will try to read and reply when I am free around 5:00 pm today |
| | | Priority | Showing to you your priority tasks and to-do list so that you focus on them and avoid unnecessary checking |
| Identity features | I procrastinate on social media to maintain positive interaction with people and respond to them on a timely fashion | Usage feedback | Usage feedback; e.g. at the end of the day, you can see statistics regarding the time you spent on social media and when such a usage conflicted with other tasks listed in your online calendar |
| | | Time restriction | Time restriction; e.g. restricting you from using social media beyond a maximum time or during certain hours of the day that you sat for yourself |
| | | Auto-reply | Auto-reply; e.g. sending an automated message to your contacts containing information such as: I am currently busy and will try to read and reply when I am free around 5:00 pm today |
| | | Goal setting | Goal setting; e.g. enabling you to set your career or life-related goals, and help you to track your progress towards achieving these goals |

**Table 2** (continued)

| SNS Features as Procrastination Triggers | Survey item | Countermeasures | Survey item |
|---|---|---|---|
| Interaction features | When I am involved in chatting, I find it hard to stop procrastinating and complete my tasks | Reminder to both users | Reminder to both users; e.g. while chatting, both of you receive a reminder telling that one or both of you may have other work to do as your online calendar suggests |
| | | Showing availability | Showing availability; e.g. your status will automatically change and declare that you have now become busy with other tasks so your friends would not expect you to continue chatting |
| | | Chatting timer | Chatting timer; e.g. a time bar showing both users the time limit for the chat and the time spent already |

### 3.2.3 Identity features and their countermeasures

Identity features enable users to represent themselves on SNSs (i.e. choose a profile picture, name, status) (Kietzmann et al. 2011; Dawot and Ibrahim 2014). Certain users provide accurate information while others provide inaccurate information. For identifiable users (i.e. those who provide accurate information), the pressure to gain followers, popularity, and influence is high and may trigger procrastination, while for anonymous users (i.e. those who do not provide genuine information on SNSs), the likelihood of being relaxed about one's online presence is significantly higher (Kang et al. 2013).

In the co-design sessions, usage feedback, auto-reply, goal setting, and time restriction were identified as the countermeasures for addressing procrastination triggered by identity features of SNSs. Usage feedback was highlighted to raise user awareness about their extent of use of a SNS, and the participants highlighted that usage data could be compared to scheduled tasks (e.g. to-do lists). Auto-reply was identified to allow users to appear present on SNSs, thereby building a positive self-image, without having to be engaging at a specific time. Goal setting can promote effective time management, particularly when reminders and suggestions are used to create motivation for operating consistently with the goals. Additionally, based on these goals, users can choose when they would like to be restricted from the SNS (based on a time frame or a time limit).

### 3.2.4 Surveillance of presence features and their countermeasures

Surveillance of presence features on SNSs triggers individuals to procrastinate by publicising their status (i.e. online and active or offline and inactive). Hence, upon accessing an SNS, the user is likely to feel as though they are being watched by others, which increases the pressure to respond to notifications, messages and other SNS-centred activities. SNSs monitor users based on the feature of transparency, which stores data pertaining to a user's SNS access history (including their last presence, current presence and location). This data may pressurise a user to respond to contacts in order to satisfy social expectations and construct a positive self-image.

Receiving auto-replies was identified by the co-design participants as a viable way to address procrastination arising from the surveillance of presence features of SNSs. Auto-reply would enable users to confirm their availability, and to let the system know when they will be free to respond to notifications from other users. The technique can manage others' expectations, meaning that they will be less likely to expect a rapid response (which relies the user of the pressure to reply instantly, enabling them to focus on the task at

hand). Additionally, consistent reminders about task priorities could combat procrastination.

### 3.2.5 Interaction features and their countermeasures

Interaction features on SNSs facilitate interactivity between users, and several studies indicate that the main reason for using SNSs for most users is to interact with others (Smock et al. 2011; Suki et al. 2012). Based on the nature of the interaction, these features can be separated into one-episode interactions and dialogue interactions. In one-episode interactions such as retweets or posts, the action cannot be repeated, and they can trigger procrastination because, periodically, many users are likely to return to the product of their interaction (e.g. a retweet) to check its statistics (e.g. in terms of likes, favourites). Additionally, one-episode user interactions often stimulate curiosity in the individual, who then begins to think about user feedback, both negative and positive. In the case of dialogue interactions, these can either be synchronous or asynchronous. In the former, timing is a relevant feature, whereas in the latter, timing is not so relevant. As such, steady streams of engagement tend to be associated with synchronous dialogue interactions, which lead to greater procrastination compared to the intermittent engagement that characterises asynchronous dialogue interactions.

Creating reminders for both users, using a timer for the interaction, and showing user availability were identified by the co-design participants as the key ways in which to mitigate the problem of procrastination triggered by the interaction features of SNSs. The participants noted that, if only the procrastinating user is reminded, this can lead to tension between the desire to stop procrastinating and the desire to be empathetic to the person they are communicating with. Therefore, reminders for both users can solve this tension that emerges. Additionally, chat timers, visible to both users (and potentially integrated into the user's calendar), could show a certain time that the interaction should stop at. Showing user availability is another reasonable way to manage user expectations about when their friends on SNSs are likely to interact.

## 4 Quantitative findings

Descriptive statistics about the preferred countermeasures for combating procrastinating arising from the identity features of SNSs are discussed in Alblwi et al. (2020). The survey design can be found in Appendices 5 and 6 of Alblwi 2020. The questions are built on the qualitative phase findings, i.e. the resulted procrastination types, triggers and countermeasures. The questionnaire also included

demographics, personality (Rammstedt and John, 2007) and self-control questions (Tangney et al 2004). The focus of this paper is on using inferential analysis to explore how the factors of gender, personality, self-control and culture can be used to predict levels of agreement towards types and triggers of procrastination; and acceptance of proposed countermeasures for procrastination.

This analysis was restricted to participants from the UK and the Kingdom of Saudi Arabia (KSA), as these were the countries which jointly provided most of the participants. A total of 288 surveys were returned, 123 (42.7%) from KSA and 165 (57.3%) from the UK. The sample from KSA consisted of 72.4% male and 27.5% female respondents, with a mean age of 31.6 (s.d. 5.8). The sample from the UK consisted of 46.1% male respondents and 53.9% female respondents, with a mean age of 24.7 (s.d. 7.4).

A series of regressions were conducted for the degree to which participants agreed with the procrastination types and triggers, and the acceptance of countermeasures, as determined by the statements in the quantitative survey.

The first set of regression models used multiple regression, with each outcome variables being the level of agreement that participants gave for how much each of the four types of procrastination applied to them. In each of these four models, the predictors were the scores on the five personality scales, the total self-control score, gender (male/female), the self-reported number of hours per day spent procrastinating on social media, and country (KSA/ UK).

The second set of regression models also used multiple regression, with each outcome variable being how much participants agreed that they were prone to each of the SNS features as triggers of their procrastination. The predictors were the scores on the five personality scales, the total self-control score, gender (male/ female), the self-reported number of hours per day spent procrastinating on social media, and country (KSA/ UK) and finally the agreement scores on each of the four types of procrastination (i.e. the four outcome measures in the first set of regression models).

The third set of regression models used binary logistic regression. The outcome variable was acceptance of potential countermeasures, operationalised as a categorical response (no/yes) as to whether the participant would accept the proposed countermeasure. The predictors in all the models were again were the scores on the five personality scales, the total self-control score, gender (male/ female), and country (KSA/ UK) and finally the agreement scores on each of the four types of procrastination.

### 4.1 Multiple regression models for types of procrastination

The model for *I often procrastinate to avoid working on unpleasant or difficult tasks* (avoidance procrastination type)

was statistically significant [F (10, 277) = 14.791, $p < 0.001$, $R^2 = 0.35$, $R^2_{adjusted} = 0.33$]. Within this model an increase in agreement with having the avoidance procrastination type was significantly predicted by an increase in neuroticism [Beta = 0.12, t(287) = 2.21, $p = 0.0.28$], a decrease in self-control [Beta = -0.39, t(287) = −6.72, $p < 0.001$], a decrease in perceived number of hours which friends spend on social media per day [Beta = −0.29, t(287) = −3.86, $p < 0.001$] and country [KSA/UK, (Beta = 0.16, t(287) = 2.99, p = 0.003], with UK participants demonstrating a higher level of agreement with this procrastination type.

The model for *I often procrastinate to change my mood and feel better* (mood modification procrastination type) was statistically significant [F (10, 277) = 2.913, $p = 0.002$, $R^2 = 0.01$, $R^2_{adjusted} = 0.06$]. Within this model an increase in agreement with having the mood modification procrastination type was only significantly predicted by a decrease in self-control [Beta = − 0.24, t(287) = − 3.54, p < 0.001].

The model for *I often procrastinate to distance myself from real-life issues* (escapism procrastination type) was statistically significant [F (10, 277) = 8.625, $p < 0.001$, $R^2 = 0.24$, $R^2_{adjusted} = 0.21$]. Within this model an increase in agreement with the escapism procrastination type was significantly predicted by a decrease in self-control [Beta = − 0.43, t(287) = −6.75, $p < 0.001$] and gender (male/female, Beta = 0.12, t(287) = 2.05, $p = 0.041$), with male participants demonstrating a higher level of agreement with this procrastination type.

The model for *When I receive a notification, I check it and spend time on that despite having other tasks to perform* (emergence procrastination type) was statistically significant [F (10, 277) = 7.103, $p < 0.001$, $R^2 = 0.2$, $R^2_{adjusted} = 0.18$]. Within this model an increase in agreement with the emergence procrastination type was significantly predicted by a decrease in self-control [Beta = − 0.31, t(287) = − 4.8, $p < 0.001$] and an increase in openness [beta = 0.13, t(287) = 2.45, $p = 0.015$].

## 4.2 Multiple regression models for triggers of procrastination

The model for *I often delay working on my tasks because I am busy checking notifications on social media* (procrastination triggered by notification features) was statistically significant [F (14, 271) = 9.316, $p < 0.001$, $R^2 = 0.33$, $R^2_{adjusted} = 0.29$]. An increase in this outcome measure was significantly predicted by an increase of self-reported hours of procrastination on social media [Beta = 0.18, t(285) = 2.31, $p = 0.021$], an increase in the level of agreeing with emergence type of procrastination [Beta = 0.27, t(285) = 4.63, $p < 0.001$] and a decrease in self-control [Beta = − 0.17, t(285) = − 2.47, $p = 0.014$].

The model for *On social media, I spend time more than I initially intended due to seeing relevant content suggested to me automatically* (procrastination triggered by immersive design features) was statistically significant [F (14, 271) = 6.603, $p < 0.001$, $R^2 = 0.25$, $R^2_{adjusted} = 0.21$]. An increase in this outcome measure was significantly predicted by an increase in the level of agreement with both the avoidance type of procrastination [Beta = 0.15 t(285) = − 2.11, $p = 0.035$] and the emergence type of procrastination [Beta = 0.26 t(285) = 4.27, $p < 0.001$].

The model for *When I send a message to someone, I keep checking whether or not they received, read or replied my message* (procrastination triggered by surveillance of presence features) was statistically significant [F (14, 271) = 3.982, $p < 0.001$, $R^2 = 0.17$, $R^2_{adjusted} = 0.13$]. An increase in this outcome measure was significantly predicted by an increase level of agreement with both the mood modification type of procrastination [Beta = 0.18, t(285) = 2.92, $p = 0.004$] and the emergence type of procrastination [Beta = 0.2, t(285) = 3.06, $p = 0.002$].

The model for *I procrastinate on social media to maintain positive interaction with people and respond to them on a timely fashion* (procrastination triggered by identity features) was statistically significant [F (14, 271) = 2.933, $p < 0.001$, $R^2 = 0.13$, $R^2_{adjusted} = 0.09$]. An increase in this outcome measure was significantly predicted by an increase in extraversion [Beta = 0.16, t(285) = 2.66, $p = 0.008$], an increase level of agreement with both the emergence type of procrastination [Beta = 0.21, t(285) = 3.25, $p = 0.001$], and the mood modification procrastination type [Beta = 0.21 t(285) = 3.25, $p = 0.001$] and country [KSA/ UK, Beta = 0.16 t(285) = 2.47, $p = 0.014$], with participants from the UK being more likely to report agreement that this feature could trigger procrastination.

The model for *When I am involved in chatting, I find it hard to stop procrastinating and complete my tasks* (procrastination triggered by interaction features) was statistically significant (F (14, 271) = 9.16, $p < 0.001$, $R^2 = 0.32$, $R^2_{adjusted} = 0.29$). An increase in this outcome measure was significantly predicted by a decrease in self-control (Beta = − 0.27 t(285) = − 3.98, $p < 0.001$), an increase in the level of agreement with the emergence type of procrastination (Beta = 0.22 t(285) = 3.77, $p < 0.001$) and gender (male/female, Beta = 0.15 t(285) = 2.8, $p = 0.005$), with female participants more likely to report agreement that this feature could trigger procrastination..

### 4.3 Binary logistic regression models for acceptance of countermeasures of SNS features as procrastiontion triggers

Binary logistic regressions models were conducted for whether participants thought a proposed countermeasure would be acceptable. As previously described each countermeasure was based on a feature of SNS that, as identified in our previous research (Alblwi et al 2019a, b), is a trigger of procrastination. There were between two to four countermeasures for each of the five SNS features. The survey item used to describe each countermeasure can be seen in Table 2.

#### 4.3.1 Predictors of the acceptance of countermeasures for notifications features as a procrastionation trigger

The binary logistic regression models for the countermeasures of auto-reply and showing availability were not significant. The binary logistic regression model for the countermeasures of Suggestions (e.g. how to mute notifications)

was significant (omnibus chi-square = 23.049, df = 12, $p$ = 0.027). This model accounted for between 7.7% and 10.4% of the variance in acceptance status, with 81.1% of the non-accepters successfully predicted, but only 39.5% of the accepters. Overall, 63.9% of the predictions were accurate. This outcome measure was significantly predicted by country (with UK participants more likely to accept this countermeasure) and an increase in having the mood modification procrastination type, and also the escapism type (Table 3).

#### 4.3.2 Predictors of the acceptance of countermeasures for immersive design features as a procrastionation trigger

The binary logistic regression models for countermeasures in the form of usage reminder and usage feedback were not significant. The binary logistic regression model for countermeasures in the form of Time Restrictions was significant (omnibus chi-square = 30.304, df = 12, p = 0.003). This model accounted for between 10 and 13.5% of the variance

**Table 3** Binary logistic regression model for acceptance of Suggestions as a countermeasure of SNS Notification features as a trigger of procrastination

| Variable | B | SE B | Wald | df | Sig | Exp(B) |
|---|---|---|---|---|---|---|
| Gender (1 = Male, 2 = Female) | .060 | .275 | .048 | 1 | .827 | 1.062 |
| Country (1 = KSA, 2 = UK) | .868 | .287 | 9.119 | 1 | .003 | 2.382 |
| Extraversion total score | −.067 | .077 | .772 | 1 | .379 | .935 |
| Agreeableness total score | −.032 | .089 | .127 | 1 | .721 | .969 |
| Conscientiousness total score | .157 | .100 | 2.470 | 1 | .116 | 1.170 |
| Neuroticism total score | .002 | .074 | .000 | 1 | .982 | 1.002 |
| Openness total score | .101 | .090 | 1.273 | 1 | .259 | 1.106 |
| Total self-control score | −.020 | .021 | .896 | 1 | .344 | .981 |
| Avoidance procrastination | −.031 | .146 | .044 | 1 | .833 | .970 |
| Mood modification procrastination | .330 | .149 | 4.926 | 1 | .026 | 1.391 |
| Escapism procrastination | −.291 | .141 | 4.241 | 1 | .039 | .747 |
| Emergence procrastination | .192 | .135 | 2.030 | 1 | .154 | 1.211 |

**Table 4** Binary logistic regression model for acceptance of Time Restriction as a countermeasure for SNS Immersive Design features as a procrastination trigger

| Variable | B | SE B | Wald | Df | Sig | Exp(B) |
|---|---|---|---|---|---|---|
| Gender (1 = Male, 2 = Female) | −.423 | .278 | 2.304 | 1 | .129 | .655 |
| Country (1 = Saudi Arabia, 2 = UK) | .021 | .293 | .005 | 1 | .942 | 1.022 |
| Extraversion total score | −.207 | .080 | 6.740 | 1 | .009 | .813 |
| Agreeableness total score | −.007 | .090 | .006 | 1 | .941 | .993 |
| Conscientiousness total score | .234 | .102 | 5.248 | 1 | .022 | 1.263 |
| Neuroticism total score | −.039 | .075 | .262 | 1 | .609 | .962 |
| Openness total score | .137 | .090 | 2.296 | 1 | .130 | 1.147 |
| Total self−control score | −.045 | .021 | 4.422 | 1 | .035 | .956 |
| Avoidance procrastination | −.065 | .153 | .180 | 1 | .671 | .937 |
| Mood modification procrastination | .009 | .147 | .004 | 1 | .950 | 1.009 |
| Escapism procrastination | −.097 | .143 | .462 | 1 | .497 | .907 |
| Emergence procrastination | .420 | .142 | 8.760 | 1 | .003 | 1.522 |

in acceptance status, with 80.8% of the non-accepters successfully predicted, and 44.8% of the accepters successfully predicted. Overall, 66.3% of the predictions were accurate. The outcome measure was significantly predicted by a decrease in extraversion, conscientiousness, self-control, and an increase in the self-reported agreement on having a procrastination of the emergence type, e.g. being distracted by social media notifications (Table 4).

### 4.3.3 Predictors of the aceptance of countermeasures for survilliance of others features as a procrastionation trigger

The binary logistic regression models for countermeasures in the form of auto-reply or priority were not significant.

### 4.3.4 Predictors of the aceptance of countermeasures for identity features as a procrastionation trigger

The binary logistic regression models for countermeasures in the form of a usage feedback or auto-reply were not

significant. The binary logistic regression model for countermeasures in the form of Time Restrictions was significant (omnibus chi-square = 29.258, df = 12, p = 0.004). This model accounted for between 9.7 and 13.2% of the variance in acceptance status, with 86.7% of the non-accepters successfully predicted, and 31.8% of the accepters successfully predicted. Overall, 66.3% of the predictions were accurate. The outcome measure was significantly predicted by a decrease in self-control (Table 5).

In addition, the binary logistic regression model for countermeasure in the form of Goal Settings were significant (omnibus chi-square = 22.486, df = 12, p = 0.032). This model accounted for between 7.5 and 10.3% of the variance in acceptance status, with 87.4% of the non-accepters successfully predicted, and 27.6% of the accepters successfully predicted. Overall, 65.6% of the predictions were accurate. The outcome measure was significantly predicted by a decrease in extraversion (Table 6).

**Table 5** Binary logistic regression model for acceptance of Time Restriction as countermeasure for SNS Identity features as a procrastination trigger

| Variable | B | SE B | Wald | Df | Sig | Exp(B) |
|---|---|---|---|---|---|---|
| Gender (1 = Male, 2 = Female) | − .307 | .281 | 1.190 | 1 | .275 | .736 |
| Country (1 = Saudi Arabia, 2 = UK) | − .027 | .299 | .008 | 1 | .929 | .974 |
| Extraversion total score | .033 | .079 | .172 | 1 | .679 | 1.033 |
| Agreeableness total score | .045 | .091 | .240 | 1 | .624 | 1.046 |
| Conscientiousness total score | .153 | .103 | 2.204 | 1 | .138 | 1.165 |
| Neuroticism total score | − .130 | .077 | 2.814 | 1 | .093 | .878 |
| Openness total score | − .078 | .092 | .728 | 1 | .394 | .925 |
| Total self-control score | − .062 | .022 | 7.981 | 1 | .005 | .939 |
| Avoidance procrastination | .166 | .157 | 1.119 | 1 | .290 | 1.180 |
| Mood modification procrastination | − .156 | .149 | 1.099 | 1 | .295 | .855 |
| Escapism procrastination | − .091 | .145 | .396 | 1 | .529 | .913 |
| Emergence procrastination | .247 | .142 | 3.026 | 1 | .082 | 1.280 |

**Table 6** Binary logistic regression model for acceptance of a Goal Setting as a countermeasure for SNS Identity features as a procrastination trigger

| Variable | B | SE B | Wald | Df | Sig | Exp(B) |
|---|---|---|---|---|---|---|
| Gender (1 = Male, 2 = Female) | − .260 | .280 | .863 | 1 | .353 | .771 |
| Country (1 = Saudi Arabia, 2 = UK) | .323 | .292 | 1.220 | 1 | .269 | 1.381 |
| Extraversion total score | − .226 | .080 | 7.921 | 1 | .005 | .797 |
| Agreeableness total score | .100 | .092 | 1.205 | 1 | .272 | 1.106 |
| Conscientiousness total score | .200 | .103 | 3.782 | 1 | .052 | 1.222 |
| Neuroticism total score | − .006 | .075 | .007 | 1 | .935 | .994 |
| Openness total score | .147 | .092 | 2.584 | 1 | .108 | 1.159 |
| Total self-control score | − .023 | .021 | 1.161 | 1 | .281 | .977 |
| Avoidance procrastination | .139 | .152 | .842 | 1 | .359 | 1.149 |
| Mood modification procrastination | .195 | .150 | 1.692 | 1 | .193 | 1.216 |
| Escapism procrastination | .005 | .142 | .001 | 1 | .970 | 1.005 |
| Emergence procrastination | .014 | .138 | .011 | 1 | .917 | 1.014 |

#### 4.3.5 Predictors of the aceptance of countermeasures for interaction features as a procrastination trigger

The binary logistic regression models for countermeasures in the form of reminders to both users and chatting timers were not significant. The binary logistic regression model for countermeasure in the form Showing Availability was significant (omnibus chi-square = 21.410, df = 12, $p = 0.045$). This model accounted for between 7.2% and 9.9% of the variance in acceptance status, with 89.9% of the non-accepters successfully predicted, and 18.2% of the accepters successfully predicted. Overall, 65.3% of the predictions were accurate. The outcome measure was significantly predicted by an increase in agreeemnt with the mood modification type of procrastination (Table 7).

### 4.4 Summary of quantitative analysis

The regression models for level of agreement with the four types of procrastination were all statistically significant, although the percentage of variance explained by several of the models was relatively low. The model with the highest level of variance explained was for avoidance type of procrastination, operationalised in the quantitative survey by *I often procrastinate to avoid working on unpleasant or difficult tasks*. Agreement with this statement increased as did neuroticism and decreased as did self-control. Participants from the UK were significantly more likely to agree that this type of procrastination related to them.

The regression models for level of agreement on how features of SNS may trigger of procrastination were also all statistically significant, although the percentage of variance explained by several of the models was relatively low. There were a range of significant predictors within the models. The two most consistent of these across models was agreement with emergence type of procrastination and self-control. Agreement with the emergence style of procrastination was

measured within the quantitative survey by the statement *'When I receive a notification, I check it and spend time on that despite having other tasks to perform'*, which would appear to be consistent with the concept of procrastination being something that can be triggered by the features of SNS. Self-control was a found to be a significant predictor of agreement with types of procrastination, agreement with SNS features as triggers of procrastination and acceptance of procrastination countermeasures. From these findings it would appear that individuals who have a greater degree of self-control are less likely to be triggered into procrastination by the features of SNS, and in turn perceive they have less need for countermeasures that would help mitigate procrastination.

Several, but not all, of the regression models to predict acceptance with countermeasures for procrastination were significant, although again the degree of accuracy of the models was relatively low measure. Self-control was again a significant predictor in several models, with an increase in self-control being predictive of a decrease in agreement that a countermeasure type would be useful. Overall, however, there did not appear to be any strong or notable relationships between procrastination type and acceptance of countermeasures.

## 5 Discussion

As demonstrated in our previous research individuals appear to agree that the features of SNS may trigger procrastination; agree that this procrastination can take on different forms; and agree that countermeasures can be used to mitigate this (Alblwi et al. 2019a, 2019b, 2020). The main finding of this paper is that, overall, factors such as gender, personality, hours of SNS use and culture (UK/ KSA) do not seem to be predictive of the types of procrastination experienced on SNS; triggers of procrastination due to SNS features or

**Table 7** Binary logistic regression model for acceptance of Showing Availability as a countermeasure for SNS Interaction features as procrastination trigger

| Variable | B | SE B | Wald | Df | Sig | Exp(B) |
|---|---|---|---|---|---|---|
| Gender (1 = Male, 2 = Female) | .404 | .286 | 1.994 | 1 | .158 | 1.497 |
| Country (1 = Saudi Arabia, 2 = UK) | − .425 | .296 | 2.064 | 1 | .151 | .654 |
| Extraversion total score | − .054 | .079 | .472 | 1 | .492 | .947 |
| Agreeableness total score | .041 | .092 | .192 | 1 | .661 | 1.041 |
| Conscientiousness total score | − .170 | .102 | 2.768 | 1 | .096 | .844 |
| Neuroticism total score | − .071 | .077 | .833 | 1 | .361 | .932 |
| Openness total score | .058 | .093 | .387 | 1 | .534 | 1.060 |
| Total self-control score | .006 | .021 | .078 | 1 | .780 | 1.006 |
| Avoidance procrastination | − .282 | .156 | 3.261 | 1 | .071 | .755 |
| Mood modification procrastination | .499 | .165 | 9.116 | 1 | .003 | 1.648 |
| Escapism procrastination | .061 | .145 | .177 | 1 | .674 | 1.063 |
| Emergence procrastination | .007 | .139 | .002 | 1 | .961 | 1.007 |

perceived acceptability of SNS facilitated countermeasure This is notable given the previously discussed research which suggests that there is an association between these factors and the experience of procrastination in non-SNS related procrastination (Steel et al. 2001; Özer et al. 2009; Nair 2017). Perhaps not surprisingly self-control was the most consistently significant predictor for procrastination related outcomes in the regression models, although again even then it was only a significant predictor in some of the models, which themselves predicted relatively little of the variance in the outcome variable. Self-control has been found in other studies to be a determinant of procrastination in relation to social media addiction (Eksi et al 2019). The procrastination type of mood modification was also a significant predictor in several models. This is consistent with previous research that has identified that procrastinated related tasks such as coursework are often identified as by individuals as stressful, boring or frustrating (Pychyl et al. 2000). We also noted in our previous research that some individuals use SNS to experience positive emotions of acceptance and appreciation at times when they are feeling lonely or isolated from their social group (Alblwi et al 2019b). This could highlight one of the key challenges in designing SNS platforms in way that does not encourage procrastination, namely that by their nature SNS cater to the fundamental human need for socialisation.

Culture was a significant predictor in several of the regression models, but to a relatively limited extent. This is of interest, given the different cultures of KSA and the UK. As reported by Hofstede Insights (2020) KSA is estimated to score substantially higher on the power distance cultural dimension than the UK. Power distance refers to the degree in which power is spread throughout a society, such as for example whether there exists a strict hierarchy within a culture. This could be expected to impact on social interactions in several ways. For example, one type of procrastination that was identified was avoidance (procrastinating to avoid difficult or unpleasant tasks). Culture was found to be a significant predictor within the relevant regression model, with participants from KSA significantly less likely to agree that they experienced this type of procrastination. This is consistent with the power distance cultural dimension, as individuals in cultures with a higher power distance may feel less able to avoid difficult or unpleasant tasks. In contrast, KSA is estimated to have a higher degree of uncertainty avoidance as compared to the UK (Hofstede Insights 2020). This refers the degree to which individuals are willing to tolerate ambiguity. However, culture was not a significant predictor for the emergence type of procrastination (checking a notification as soon as it is received), which it could have been expected to be as unread notification could be considered a form of ambiguity. UK culture is estimated to also display higher levels of individualism than KSA. Individualism refers to the degree of interdependence between members of a society, characterised by Hofstede Insights (2020) as whether an individual's self-image defined by 'I' or 'we'. KSA is considered a collectivistic culture on this dimension, where individuals are driven towards maintaining strong relationships and considering the welfare of their wider group. As such this is factor that could be expected to be linked to social media and in turn SNS facilitated procrastination. Nevertheless, there was again a lack of strong or notable relationships between culture and acceptance of procrastination countermeasures. Overall, the relative lack of on an impact of culture on SNS related procrastination may be an indication that behaviour on SNS transcends geographical and cultural norms of behaviour. This reflects one of the fundamental questions posed within the field of cyberpsychology, which is whether the internet enhances or transforms behaviour (Suler 2004). In the case of SNS related procrastination it may be that the norms of SNS use are greater and more persuasive than the cultural norm that the individual operates within.

Some of the inconsistencies within the research literature may relate to methodological issues. As was the case in this study procrastination is usually a self-reported measure. It has been noted that self-reported procrastination can differ from observed procrastination, which may indicate that self-assessment of procrastination is influenced by self-concept (Steel et al 2001). In the study by Chen et al. (2020) it was demonstrated through sentiment analysis of social media that procrastination is viewed negatively. It is possible that this creates a social desirability bias when self-report is used, leading individuals to under-report their levels of procrastination. This is where technology may be able to contribute by enabling the collection of the objective data, such as for example use of social media apps by students around the time of assignment submission. Further, the types of social media facilitated procrastination that were used in the analysis were derived from the participants themselves, although the method through which these types were elicited was based our review of the research literature. As discussed elsewhere (van Eerde and Klingsieck 2018) procrastination is a complex and under-researched topic. There may be conflation with other areas such as digital addiction, although there is also a lack of consensus and clear conceptualisation within that area as well (Almourad et al 2020). We do not claim that the measure of procrastination that we used to elicit the attitudes towards procrastination countermeasures are equivalent to fully developed and tested psychometric measures of procrastination.

Only two cultures are were compared in the analysis. Including a greater range of cultures in the future research may identify cultural factors predict types, triggers, and acceptable countermeasures of procrastination. If cultural is a relevant factor, then this is something that online systems

to counter procrastination can be designed to account for. Similarly, if future research identifies that individual factors such as gender and personality are relevant to procrastination prevention and intervention strategies then online systems can be designed to provide tailored messages. In addition to these limitations, it should be acknowledged that basing the types of procrastination used as predictors on the opinions of participants may have some bias. Nevertheless, prompting individuals to consider their own patterns and styles of procrastination may have benefits. This type of meta-cognition is the basis of cognitive behavioural therapy, which has been identified as one of the most effective treatments for procrastination in offline therapeutic sessions (van Eerde and Klingsieck 2018).

The results of this study demonstrate new avenues through which procrastination can be addressed. As van Eerde and Klingsieck (2018) note that there is mixed evidence over whether procrastination can be changed, with some research suggesting that it has a genetic component (Gustavson et al 2014) and elements of a stable traits (Steel 2007). However, studies have also documented what appears to be changes in procrastination over time (van Eerde and Klingsieck 2018), which would suggest there is a degree of malleability involved. Use of SNS analysis may provide the additional data needed to provide a better understanding of procrastination, and in turn more evidence-based prevention and intervention approaches. Whilst we did not find any factors that were strongly predictive of SNS related procrastination or acceptance of countermeasures it is possible that future research could identify other relevant factors. One advantage to studying SNS related procrastination is that the medium provides high volumes of data about the behaviour of the individual, through which procrastination may be identified. Changes within the design of SNS may also provide natural experiments than can be used to better determine the relationship between design features and the triggering of procrastination. Overall, better use needs to be made of the data available. As commented by van Eerde and Klingsieck (2018) procrastination is a topic often covered by self-help books, which may not be based on scientific evidence. It has also been observed that managed procrastination may be used to relieve stress, improve mood and increase work efficiency (Ivarsson and Larsson 2011). This suggests that a more nuanced approach to the management of procrastination may be needed, where individuals can experience the benefits of procrastination whilst mitigating the harmful consequences. In the case of SNS facilitated procrastination these strategies are not limited to being implemented after the problem has developed, instead using appropriate design and intelligent monitoring problematic procrastination may be prevented.

# 6 Conclusion and future work

In this paper, we studied predictors between various personal factors and proneness to procrastination on SNS sites and also acceptance of a new range of SNS features to combat it. We argued the dual role of SNS in both triggering and, potentially, mitigating procrastination. Our findings showed that users who self-declared to have frequent procrastination on SNS are generally welcoming to having new SNS features to help them mitigate it. They also agreed that their procrastination falls into one or more of the four types of procrastination that we identified. They also agreed on the role of different social media features in triggering their procrastination. There did not appear to be any strong relationships between the type of procrastination experienced and the acceptance of the different types of countermeasure. This may suggest that, despite there being different manifestations of procrastination, potential countermeasures may act upon shared, underlying characteristics of procrastination. However, as SNS become increasingly targeted and personalised it is possible that specific, future design features may become more salient to individuals who experience specific type of procrastination. Neuroticism and self-control were significantly able to predict the type of procrastination. This would mean the ability to personalise SNS to avoid triggers, for example, the emergence type of procrastination for users with some personality traits, through reducing notifications or providing users with advanced ways to filter and customise them. According to Alutaybi et al. (2019a, 2019b) and also Alblwi et al. (2020), the simple ways offered by commercial social networks and digital wellbeing tools of muting notification all together or encouraging a time off can create anxiety, fear of missing out and passive procrastination. In our future work, we will focus on the design methods of countermeasures in a user-centred style catering to the actual user experience with such countermeasures in a real-world context. Given the innate conflict between the need to procrastinate, e.g. to change mood, and the serious task being delayed, our tests and design methods for such countermeasures shall also strive at minimising reactance to them in users and at the same time making them visible and perceived to be useful and worth a try. Applying AI and machine learning can help drawing a rich user model derived through previous interactions with and on social networks. With additional input from tools like calendars, timers, fitness apps and the like, such AI can draw a better picture of user habits, lifestyle and types of procrastination and preferences towards it countermeasure. The use of intelligent recommendations, i.e. our proposed countermeasure of Suggestions and Goal Setting, is also a promising direction for future work.

## Compliance with ethical standards

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