

How Can Social Networks Design Trigger Fear of Missing Out?

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Abstract— Social Network Sites (SNSs) are meant to facilitate interaction between people. The design of SNSs employs persuasive techniques with the aim of enhancing the user experience but also increasing interaction and user retention. Examples include the personalisation of content, temporarily available feeds, and notification and alert features. Socialness is now being embedded in new paradigms such as the Internet of Things and cyber-physical systems where devices can link people to each other and increase relatedness and group creation. One of the phenomena associated with such persuasion techniques is the experience of Fear of Missing Out (FoMO). FoMO typically refers to the preoccupation of SNS users with being deprived of interaction while offline. The salience, mood modification and conflict typically experienced as part of FoMO, are symptoms of digital addiction (DA). Despite recognition of the widespread experience of FoMO, existing research focuses on user psychology to interpret it. The contribution of SNS design in triggering FoMO remains largely unexplored. In this paper, we conduct a multi-stage qualitative research including interviews, a diary study and three focus group sessions to explore the relationship between SNS features and FoMO. Our findings demonstrate how the different SNS features act as persuasion triggers for certain kinds of FoMO. Also, we suggest features that could be introduced to social network sites to allow individuals to manage FoMO and identify the principles and challenges associated with engineering them.

Index Terms— Fear of Missing Out, Social Networks, Digital Addiction, User Experience

I. INTRODUCTION

Although technology may be useful in all parts in daily life, it may be partially responsible for encouraging problematic use styles, such as obsessive and addictive usage. Technology enables people to socialise remotely and socialness is being embedded in new paradigms such as the Social Internet of Things (SIoT) [1] whereby humans co-own and connect through objects equipped with sensing and communication capabilities that are used in everyday life activities. Traditional social networking is already established through conventional websites and mobile applications allowing continuous access; e.g. Facebook, Instagram, Snapchat, Twitter and WhatsApp. Such SNSs provide interactive platforms that enable people to communicate, build and maintain friendships and look at real-time information and events. However, one of the costs associated with this ubiquitous opportunity for interaction is the FoMO which typically refers to a preoccupation with gaining more interaction opportunities and a loss prevention

ability when SNS users are offline or unable to connect and communicate on demand. FoMO is also defined as a “pervasive apprehension that others might be having rewarding experiences from which one is absent and is characterised by the desire to stay continually connected with what others are doing” [2]. FoMO in relation to SNSs motivates people to check their SNS interactions frequently or stay online continuously. In addition, people who have chronic deficits of psychological needs of satisfaction may feel an increased need to frequently interact with others, even when this happens in unsuitable or dangerous situations such as while driving [2] or attending lectures [3]. Hence, minimising the FoMO and even offering countermeasures for it can be argued as being part of the social responsibility of SNS companies.

Researchers have recently begun to investigate the negative impact of the addictive use of technology (including FoMO) on SNS users [3-5]. The investigation suggests that those experiencing such problematic digital usage may display psychological disorder symptoms such as depression and negative feelings [6]; insomnia, eating disorders [4]; low life competency [5]; emotional tensions [7, 8]; negative effects on physical well-being [3]; anxiety [7]; and emotional control [9].

People may experience anxiety when they are unable to connect to cyberspace at any time or when they are not receiving reactions and interactions to their activities [10]. Fox and Moreland [11] stated that FoMO is the main reason why people use Facebook extensively and feel pressure to do so. While the underlying reasons for FoMO are diverse, SNSs and technology could be designed in a way that persuades people to remain in control of their usage [12].

The design of SNSs utilises several persuasive principles to keep user interaction active and increase retention. Examples include temporarily available content such as stories and feeds (scarcity) [13], timed context-sensitive and personalised feed news (personalisation and suggestion persuasion principles) [14]. The grouping feature, which can connect two or more individuals privately online, is another example of using persuasive principles, mainly relatedness in self-determination theory (SDT) [15], social proof [13], and surveillance [14]. SNSs are designed to use these features to create a sense of belonging and popularity; i.e. to boost relatedness. However, the desire to belong can turn into FoMO when people are unable to connect with others and do not receive the interaction and reactions to their posts they expect; i.e. they fear of missing popularity and the right understanding of the causes of an unexpected lack of online social interaction. The tagging feature creates peer pressure to interact on SNSs as well. This

exploits the normative influence principle [16] and the need to conform and prove responsiveness and empathy.

Presence features on SNSs provide individuals with knowledge of the online availability of others and this acts as a persuasion trigger for FoMO. This reflects the social trace approach to the behaviour change support system in which the system indicates the presence of others [17]. However, presence features could facilitate FoMO; e.g. fear of missing the ability to be popular [18] when others are shown to be present but are not reacting. Impression features (e.g. number of contacts who have seen a post) may motivate people to increase their presence on SNSs and interact more due to the fear of missing the ability to retain their followers. Moreover, a number of companies use SNSs as a means of sharing valuable opportunities with followers such as careers or discounts. Thus, people may be staying online or thinking about advertisements because they fear of missing such economic opportunities. Hence, we may argue that opportunism is another trigger for FoMO that is being used by de facto SNSs.

In this paper we build on the work conducted in [18] and delve into the details of the role of SNS design features as triggers for FoMO. We conduct a multi-stage qualitative research study and concretise the relationship between the main families of SNS design features, taking the Honeycomb framework as a starting point [19] and the different situations in which FoMO occurs. Our results are intended to inform the design of future SNSs to minimise the negative effects of persuasive features and offer tools to help users manage their experience better and combat the FoMO.

II. RESEARCH METHOD

Our research extends previous work conducted by Alutaybi et al. in [18] which consisted of focus group sessions involving five-to-eight participants and a diary study with twenty participants who participated in the focus group sessions. In this paper, we extend this with further studies and explore the relationship between the main features of SNSs, taking the Honeycomb framework as a start and the different situations in which FoMO takes place. The honeycomb framework was introduced as an explanation to identify SNS functions. Seven functional blocks comprise the framework: *Groups* (the extent to which individuals can create their own groups), *Sharing* (the extent to which people exchange, distribute, receive and share their photos, audio and video), *Reputation* (the extent to which people can recognise other peoples' level or themselves regarding their reputation through their status, friends list and shared content), *Conversation* (the extent to which people communicate with others via social networks such as sending messages, commenting and chatting), *Identity* (the extent to which people disclose their identity on social networks such as their name, gender, age, qualifications and hobbies), *Presence* (allows individuals to know the existence of other individuals from their profile and status), *Relationships* (the extent to which individuals relate).

To achieve this objective, we conducted a new study comprising three phases: introductory interviews, diary study and focus groups. Table 1 outlines the data collection methods used in this study.

Table 1. Data collection methods used

Phase	Method used	Brief Explanation
1	Interview	- With 16 participants – Familiarising them with the issue – Familiarising them with the FoMO classification concluded from the analysis of the 1st study - Extracting opinions and suggestions - 40 minutes for each interviewee
2	Diary study	- With the participants from the first phase - Daily basis - Recording personal stories - Investigating new categories of FoMO
3	Three focus group sessions	- With 15 participants from the second phase – Scenario-based sessions - To discuss their diary entries and elaborate on them

The first phase consisted of an introductory interview phase with 16 participants aged between 18 and 30 years who self-declared their frequent FoMO experiences in relation to SNSs. Participants were recruited using an open call to a student forum, where individuals could self-nominate themselves to participate. Interviews were used to double check the selection criteria and familiarise the participants with FoMO in its different facets and manifestations to engage them in the issue. They were also issued with instructions detailing how to complete the template of the next diary study including a practice diary form. The participants were given a printed copy of the diary template and were offered explanations regarding its meaning in detail.

The second phase consisted of the diary study itself with the same 16 participants who were interviewed and inducted in the first phase. When completing the diary form, the participants received a template via email each day for two weeks. The participants were asked to complete the diary as soon as a FoMO experience occurred. To support them further, they were given a list of different FoMO categories provided in the template. They were asked to attempt to reflect on the FoMO categories, their FoMO experience and their personal experience. The participants were asked to suggest new categories to add to the list if they could not find sufficient existing categories to describe their experience and they were told to feel free to annotate them by adding or rephrasing concepts. The participants were sent text message and email reminders when they failed to submit their diaries promptly.

The third phase consisted of three focus group sessions with a total of 15 participants to elaborate their personal stories from the diary study. Each group consisted of five members and was given five scenarios covering different aspects of FoMO with a set of relevant questions. An open discussion subsequently took place. The study was approved by the ethics committee of the authors' institution. The diary studies provided scope to explore the lived experience of FoMO and to collect more eco-logically valid data. Meanwhile, the focus groups allowed us to elaborate on the diary notes and conclude.

III. FINDINGS

A. Conversation

The conversation feature represents the facilities that enable people to communicate with each other on social networks by exchanging messages, comments or chatting. This feature can trigger a number of FoMO cases but in different situations, as presented in Table 2. Conversation feature (especially if

spontaneous) may motivate individuals to change their online behaviour and be online to mitigate their FoMO.

Table 2. Conversation-related FoMO vs SNS Usage Context

Conversation-related FoMO	SNS Usage Context
Fear of missing information due to the large volume of information	Unable to interact or connect as wished
Fear of missing the ability to deal with different social networks	Unable to interact or connect as wished
Fear of missing timely interaction	Unable to interact or connect as wished
Fear of missing participating in popular interactions	Unable to interact or connect as wished
Fear of missing empathy and leaving a good impression	Having to or feeling a need to engage in continuous untimed interactions
Fear of missing the opportunity to know others' impressions	Having to or feeling a need to engage in continuous untimed interactions
Fear of losing popularity	Having to or feeling a need to engage in continuous untimed interactions
Fear of missing a spontaneous response	Having to or feeling a need to engage in continuous untimed interactions
Fear of missing the ability to be popular	Online social gathering is expected
Fear of missing the opportunity to attend an online event	Online social gathering is expected

- Fear of missing information due to large volumes of information:** Today a lot of active social network sites' users complain that their streams have become too overloaded and it is difficult to pick out useful information [20]. Consequently, Fear of missing information due to large volumes of information may be experienced and triggered by conversation features when the volume of conversations is high and people cannot access or respond to them. Hence, people become preoccupied with missing or accessing an important post or message, as opposed to the case when a few messages from the same conversation channel are received. One participant in our study commented: *"There was a debate on Twitter about a harassment accusation an actress had made against another actor and the actor denied all accusations. Twitter was full of comments. I was driving and could read only a few so I was afraid that I might miss some new development."*
- Fear of missing the ability to deal with different social networks:** This kind of FoMO is triggered by the conversation features that occur when individuals encounter multiple conversations on different SNSs. Thus, they find it difficult to interact with all of them at the same time, leading to the fear of missing something important or interesting. One participant commented: *"I have to reply to messages that come from Facebook and WhatsApp but I was thinking who to reply to first to, so I really feared having to deal with those messages at the same time."*
- Fear of missing timely interactions:** Conversation can trigger the fear of missing a timely interaction when

individuals feel persuaded to respond to a certain message and are unable to do so. From the participant's point of view, fear of missing timely interaction occurs *"when individuals could not check their SNS in order to see if anyone has messaged them. Thus, "they fear missing interactions that need them to interact instantly. This happens when individuals do not know whether friends know they are unable to interact or connect."*

- Fear of missing participating in popular interactions:** Conversation can facilitate this kind of FoMO which occurs when there are important events such as football match happening, and people cannot be involved for some reason such as driving or studying. As a result, they may be concerned about missing something important that friends or followers were discussing during the event.
- Fear of missing empathy and leaving a good impression:** Conversation features could trigger this kind of FoMO when someone is unable to reply or terminates a conversation. Thus, fear manifests itself as a fear of missing empathy, fear of not leaving with a good impression, or fear of missing important messages which are part of a long conversation. For example, one participant commented: *"My friend was talking to me about a personal matter and I could not stop using WhatsApp as I feared my friend would think I did not want to listen to him."* This reflects the social psychological concept of the persuasive norm of reciprocity, in which we feel obligated to return the effort that others have put into helping us [13].
- Fear of missing the opportunity to know others' feedback:** Occasionally people send a message through SNSs to get feedback from others and thus stay online in order to receive their response. Conversation features in SNS can be subtle and include implicit mutual interaction such as reciprocal likes and comments. For example, *"I posted a picture on Instagram and I was checking my phone regularly throughout the day as I feared missing my friend's comments that may need me to reply."* These concerns relate to impression management, in which we are driven to manage how we are perceived by others and to monitor our success in achieving our desired social image [21]. As such, we are driven to track whether we have been successful in our attempt to manipulate how we are seen by others and to perform quick, corrective actions if their response suggests that we have failed in our goal.
- Fear of losing popularity:** Conversation feature designs in SNSs may facilitate the fear of missing popularity. A conversation feature could motivate people to be online in order to reply to messages. The reason behind this is that people may perceive that responding immediately to the message may preserve or increase their popularity. For instance, one participant who strongly felt the urge to provide prompt responses said: *"I keep checking my WhatsApp continuously to see if I have any message as I have a habit of replying immediately in order not to lose my popularity and also I do not want anyone to feel that I ignore them."*

- **Fear of missing a spontaneous response:** Occasionally, communication via SNSs is not bound by time so when people send a message to someone they do not know when they will receive a response. Hence, such messages could persuade people to continually check in order not to miss a spontaneous response because they think that they have to respond; e.g. *“I had to meet my friend regarding the assignment that was due today but they didn’t tell me at what time they’d meet me, so I kept checking my WhatsApp as I feared missing spontaneous responses from him.”*
- **Fear of missing the opportunity to attend an online event:** When people experience this kind of FoMO, they fear missing the live chat. This can occur when a certain online event on a certain SNS allows people to chat during the event. Live chats can facilitate this kind of FoMO due to *“someone’s inability to be part of a live chat.”*

B. Grouping

A grouping feature is a facility that can connect two or more individuals privately online. This feature can trigger a number of FoMO types but in different situations (see Table 2) and drive people to accept the norms of the online group in order to feel a sense of relatedness and popularity. Table 3 presents the association between this feature and certain kinds of FoMO.

Table 3. Grouping-related FOMO vs SNS Usage Context

Grouping-related FOMO	SNS Usage Context
Fear of missing valuable information	Unwilling to engage in social interaction
Fear of missing the sense of relatedness	An online social gathering is expected
	Having to or feeling a need to engage in continuous untimed interactions
Fear of missing the ability to defend your popularity	Unwilling to engage in social interaction

- **Fear of missing valuable information:** Individuals participate in group to realise benefits from doing so such as news or times of social gatherings. However, the group setting may facilitate FoMO by making people fear of missing valuable information when the group is active while they are unwilling to participate in its activities. For instance, one participant commented: *“due to the Easter holidays, the group on WhatsApp was active as everybody wanted to catch up with each other. I was not interested in interaction with the group but I feared that if I did not interact, I might lose [a chance for a group] party or dinner.”*
- **Fear of missing the sense of relatedness:** Individuals participate in groups to satisfy their needs to belong and, hence, maintain their popularity. However, the timing of the group gathering may facilitate FoMO when it is unknown. *“This could drive people to be online in order not to miss group gatherings that make them feel more related to the group.”*
- **Fear of missing the ability to defend popularity:** Individuals tend to be active members in a certain group to

satisfy their need to maintain their popularity. However, the group setting may facilitate FoMO by driving people to continually engage with the group’s activities when they do not wish to in order to maintain their loyalty and popularity in the group. For instance, participants mentioned that if they do not participate in the group, their need to feel popular within the group cannot be satisfied and this is a clear example of fear of missing something. Within the group dynamic [22], there is a motivation to conform to the norms of the group (normative behaviour) in order to retain a sense of belonging to the group and maintain the desired level of perceived popularity and connectedness. For instance, one participant commented: *“I got so stressed because my friends wrote dozens of messages on the WhatsApp group but they did not say anything important. I didn’t have time to engage and I also wasn’t in the mood to interact but I feared that I would become less popular amongst them.”*

- **Fear of missing the sense of relatedness:** Individuals prefer to be a member of a group to feel a sense of relatedness. However, the group may facilitate this kind of FoMO by driving people to continually check the group’s activity in order to gather knowledge about members and involve them when necessary. One of the techniques that support the need for relatedness in SDT is dependability by showing availability in case of need. The participants mentioned that if they did not check their online group, that may affect the satisfaction of the need for relatedness. For instance, one participant commented: *“I kept on checking WhatsApp groups to see what my friends were doing and become involve when they needed help.”*

C. Presence

Presence features allow people to express their existence and availability on a SNS to other individuals; e.g. online but for urgent matters only. This feature can trigger a number of types of FoMO (see Table 4) and persuade people to stalk or even annoy others in order to reduce their FoMO.

Table 4. Presence-related FoMO vs SNS Usage Context

Presence-related FoMO	SNS Usage Context
Fear of missing the ability to be popular/fear of missing the ability to get the right interpretation	Others do not interact as expected

- **Fear of missing the ability to be popular:** Presence features could contribute to triggering this kind of FoMO in which individuals are conscious of the presence of others on a certain SNS but do not receive expected interactions from them. For example, one participant commented: *“I was on a holiday, so I thought about catching up with my friends. I sent WhatsApp messages to some of them expecting a reply from those who were online but I did not receive any. I got really anxious about missing any interaction with them before so they might ignore me deliberately.”*

- **Fear of missing the ability to get the right interpretation:** This kind of FoMO could be triggered by the presence feature. This can occur when people do not receive the expected interaction and reactions from others. Hence, they may become anxious due to an inability to get the right interpretation and become confused about the situation. For example, one participant who was wondering about not receiving interactions from their friends said: *“I posted expecting good comments. However, I did not receive anything from some of my friends who were online. So, I thought that they were not commenting on my post because they may not find the subject that I was tweeting about interesting so may have ignored it. On the other hand, it could be that they did not understand what I was talking about and chose not to interact.”* Users can try to satisfy their curiosity by checking other SNSs to see whether their contacts are responsive elsewhere on SNSs.

D. Sharing

The sharing feature allows people to exchange, distribute, receive and share information including text, photos, audio and video. This feature can persuade a number of types of FoMO (see Table 5) and motivate people to change their online behaviour; i.e. increase the time spent connected to SNSs.

Table 5. Sharing-related FoMO vs Usage Context

Sharing-related FoMO	SNS Usage Context
Fear of missing information due to the large volume of information	Unable to interact or connect as wished
Fear of missing information/events due to multi following	Unable to interact or connect as wished
Fear of missing a valuable opportunity	Having to or feeling a need to engage in continuous untimed interactions

- **Fear of missing information due to large volume:** When the amount of shares that people post on SNSs is abundant, it may facilitate this kind of FoMO if individuals feel unable to interact with it. Such a kind of FoMO can arise *“when individuals could not interact on a certain SNS due to a given circumstance and also a large volume of posts such as stories on Snapchat and Instagram. It is difficult to scroll through them and pick out the ones that individuals really want to see, which means that they may fear of missing an important post.”*
- **Fear of missing information/events due to multi following:** This can occur when the volume of sharing is considerable and people are unable to interact with it due to the numerous followings that they have and the shares resulting from them. For instance, one participant stated: *“I follow many people on Instagram, many of whom post multiple times a day. It is hard to keep up with all of the new information and I worry I will miss important posts.”*
- **Fear of missing a valuable opportunity:** In this study, sharing appears to trigger this kind of FoMO. This can occur when the content of a share can be valuable and, thus, people tend to be online in order not to miss such an

opportunity. For example, one participant commented that: *“There was a rumour about tickets becoming available for a football match and it was deciding match between two rivals. So, I kept checking the latest updates for available tickets on the Facebook page in order to not miss this valuable opportunity.”*

E. Impression

The impression feature informs people how many individuals react to their SNS shares such as the number of ‘Likes’ or ‘Retweets.’ This feature can trigger several kinds of FoMO (see Table 6) and, thus, people may change their online behaviour in order to give a good impression; i.e. people may be preoccupied with how to make their online photo interesting to give a good impression.

Table 6. Impression-related FoMO vs SNS Usage Context

Impression-related FoMO	SNS Usage Context
Fear of missing the ability to be interesting	Others do not interact as expected
Fear of missing the ability to be popular	Others do not interact as expected
Fear of missing the ability to retain followers	Unable to interact or connect as wished
Fear of missing the opportunity to know others’ impressions	Having to or feeling a need to engage in continuous untimed interactions

- **Fear of missing the ability to be interesting:** Individuals are concerned with the extent to which others are interested in their content and messages. However, this feature may trigger this kind of FoMO in which people *“monitor the number of reactions but if they do not receive the expected reactions, they fear that their post is not interesting enough to make others interact with it.”*
- **Fear of missing the ability to be popular:** Participants in the diary study and focus group sessions highlighted the importance of the impression feature for gauging their popularity among peers, especially when they do not see the expected reactions. For example: *“I did not receive ‘Likes’ on photos from a number of my friends as I expected. This made me anxious as I feared I missed some interaction with them recently which led to them ignoring me.”* These concerns relate strongly to impression management, in which we are driven to manage how others perceive us and to monitor our success in achieving our desired social image [21].
- **Fear of missing the ability to retain followers:** The impression feature can trigger a fear of missing the ability to retain followers when *“individuals do not receive impressions from their followers regarding their post. As a result of not getting the impression, they attribute this to the lack of their activity on SNSs which makes followers uninterested in their profile.”*
- **Fear of missing the opportunity to know others’ impressions:** Participants emphasised the importance of the

impression features in motivating them to be online in order to know what others think of them. The impression feature possibly triggers this kind of FoMO when people feel a need to engage in continuous untimed interactions, fearful of leaving a negative impression by failing to respond to feedback from others. For example: *“I posted a picture on Snapchat so I constantly refreshed my Snapchat because of the fear of missing what my friends said and it may need me to respond and appreciate them for their impression.”*

F. Delivery Report

This is a feature which confirms that a message has been delivered and seen by the recipients. Such a receipt could be in the form of checkmarks or a change in colour. For example, on WhatsApp, when the message is delivered, two checkmarks are placed under the message. Fear of missing the ability to be popular can be triggered by this feature when individuals have seen *“their message is delivered to a certain person or group and is read but has not received interactions from them.”* Delivery reports are designed in a basic form that does not tell whether the message was accidentally checked and whether the person is busy or planning to reply later. Such a lack of context sensitivity makes such reports subject to misinterpretation and FoMO.

G. Temporarily Available Content

This is defined as content that is available for a specific period of time and then expires or is removed. This feature is a new function and explored in terms of the functionality of SNSs. It may trigger a fear of missing temporarily available information, as evidenced by participants who mentioned that temporary posts could motivate them to be online in order not to miss this information. A participant stated: *“I do not have any 3G at the moment, so when I was on my break from work I could not check social media. This led to a fear of missing my friends’ Snapchat or missing stories on Instagram as these are time-limited.”* This exploits the scarcity principle of influence [13]. When this situation arises, individuals may be persuaded to follow a deviant and undesired social interaction; e.g. validating with friends via a phone call about such interaction in order to mitigate this kind of FoMO.

H. Length of Messages

This feature shows the length of an audio message. It is a new function and is explored in terms of the functionality of SNSs. Such a feature may trigger a fear of missing timely interaction when people are unable to interact or connect as they wish, as evidenced by those participants who mentioned that temporal events trigger this kind of FoMO. One participant stated: *“I received a voice message on WhatsApp from my sister, along one of 1.44 minutes but unfortunately I was in a lecture. Due to the length of it, I was concerned it was something important and, thus, I feared missing it.”*

I. Notification

This is defined as the action of notifying people when a message comes to them using a different tone. Frequent notifications can trigger a fear of missing important

information due to being unable to check this notification (e.g. *I got a frequent notification when I was busy. Because of these notifications, I feared that my friends thought I was being rude by not responding. I also feared that I may miss something.*)

J. Tagging

Tags are defined as a feature that allow SNS users to engage an individual, business or any entity with a social profile when they mention them in a post or comment. On Facebook and Instagram, tagging notifies the recipient and hyperlinks to the tagged profile. This feature may contribute in triggering the fear of missing the ability to defend popularity by making people experience this kind of FoMO when they are not interested in being online. This kind of FoMO can arise when a peer ‘tags’ their friend on a certain SNS. Although the friend may be unwilling to interact, this situation can act as peer pressure and cause the friend to experience this kind of FoMO. One participant stated: *“An old friend tagged me in a tweet today but I was unwilling to respond. After a couple of hours I thought it might make me look bad to other people who may have seen the tweet if I did not respond so I feared of missing my popularity.”* This reflects the normative influence principle in which we feel pressure from peers to interact on a certain SNS when we are unwilling to interact.

IV. ANTI-FoMO DESIGN OF SOCIALLY NETWORK SITES: FEATURES AND CHALLENGES

Although on one hand SNSs are a medium for facilitating FoMO, on the other hand they can provide usage regulation, self-regulation and mindfulness tools to combat FoMO. Tools to help with digital wellness are emerging; e.g. Apple Screen Time and Google Digital Wellbeing. However, they are mainly concerned with managing technology usage time and avoiding excessive and unconscious usage. Such solutions are typically time and usage management tools whereby the user’s preoccupation with FoMO is left to the user themselves to manage. In our previous study [18], we identified a number of software-assisted mechanisms that can combat different types of FoMO and can also be added to SNS designs. We present some of those proposed mechanisms below:

- **Filtering:** This mechanism enables individuals to classify messages and notifications based on certain criteria such as the topic and contacts involved. Thus, individuals can easily estimate their subject and importance. Such a system is currently used by some email systems such as Google Gmail which classifies emails as ‘Primary,’ ‘Social’ and ‘Promotions,’ thus enabling individuals to identify important emails more easily and reduce their FoMO. Filtering mechanisms may combat the fear of missing content and information due to a high volume of information and reduce the time taken to search for particular information.
- **Event and content recorder:** This mechanism records events and content while a person is offline to be viewed when they are online again. Such a mechanism may help individuals to regulate their fear of missing temporarily available content. Individuals are less likely to fear missing

such content (e.g. stories on Snapchat or Instagram) if they know they are able to view the stories the next time they log on to SNSs.

- **Alternative notification:** This mechanism allows people to receive notifications from SNSs without having to use a social media app; e.g. via SMS or a vibration on their smartwatch. This technique may be useful for reducing the compulsive behaviour of checking social media frequently and procrastinating due to checking further content. However, it may lead to habitual checking behaviours (e.g. checking the smartwatch frequently) and, therefore, may be of limited benefit for reducing FoMO.
- **Priority list/importance level:** This mechanism helps people to specify the level of importance and relevance to topics or contacts so that they are better able to prioritise. While FoMO in general leads people to stay online in order not to miss out on the interaction with others, this particular mechanism can mitigate some of the feelings of FOMO, namely the fear of missing the opportunity to know someone else's impression or fear of missing the ability to deal with different social media accounts and notifications.
- **Set status and time:** This mechanism helps people to set their current status and calendar availability in advance to show their contacts whether or not they are online and available to interact. People usually encounter a number of FoMOs when social groups do not interact with them as expected. However, setting a status and time may alleviate the level of a certain FoMO for both parties.
- **Auto-reply:** This is a technique that informs individuals that a certain person is away in order not to expect an immediate response from the person. In doing so, individuals can set some form of auto-reply that sends an automatic response to inform your messaging contacts that an individual cannot respond immediately. This technique is useful for people who are preoccupied with missing timely interaction when they are unable to interact or connect to a certain SNS and interact with their contacts.

There could also be another tool for use by groups of people in order to combat FoMO. For instance, a group may collectively agree to disengage from their social media for a specific time period, either every day or for a period of time, as in the case of a group of students who need to focus their attention on studying for an exam. Expectations could be managed by the group leader who could turn off posting. This mechanism may help individuals to manage their FoMO in relation to individual groups (e.g. fear of missing valuable information in an online group when individuals do not want to engage in each interaction). However, this mechanism may potentially create conflict if people have different goals and needs. This issue can be resolved by using a software-assisted tool based on a negotiation approach.

However, in terms of how these mechanisms for combatting FoMO are applied without negatively affecting user experience and quality requirements, we argue that there are a number of dilemmas that could be encountered:

- **Contacts' lack of commitment:** Some mechanisms should be set mutually by contacts to minimise or regulate each other's FoMO. However, if those contacts do not commit to set such a mechanism, they may generate a negative user experience for other contacts. Although this issue could be corrected by embedding persuasive techniques such as rewards or badges (e.g. when certain individuals set a certain mechanism regularly, they may be rewarded by a new avatar), persuasive technologies may cause individuals to experience frustration, anxiety, intense peer pressure and guilt when they are not following the system [23]. On the other hand, FoMO could be regulated by a moderator; e.g., the group moderator turning off commenting provided that no other members had access to this feature
- **Fewer gratifications:** Individuals select SNSs to gratify their needs such as diversion, personal relationships and surveillance. However, the ways in which such regulation tools are applied may affect people's need for gratification. For instance, individuals may choose to be a member of a group on Facebook to feel a sense of relatedness (need) but mechanisms limiting them from checking the group frequently (such as turning off commenting) may lead to them feeling less related to the group. However, this issue can be dealt with by giving individuals suggestions based on their profile data (e.g. alternative offline activities) that could compensate for the lack of some of their gratification needs. Thus, their fear of missing a sense of relatedness may be reduced.
- **Increasing compulsive behaviour:** Although tools can regulate SNS usage in relation to FoMO, it is possible that such tools may lead to other compulsive behaviours such as using alternative notifications; e.g. SMS or a vibrating smartwatch to help minimise compulsive checking of social media and, thus, reduce screen time and procrastination after the initial checking. However, it may lead individuals to check their smartwatch regularly in order to see whether they have any notifications. In this case, alternative notifications have merely shifted the problem from SNSs to the smartwatch as opposed to tackling the root cause of the problem. Comparisons between peers using gamification elements such as progress bars and points systems may also shift the issue to the gaming domain where the problem is trivialised and individuals have an alternative medium for FoMO.
- **Information overload and increased social network usage:** Although we have suggested a tool to minimise FoMO by recording temporal content, there is a danger that this could increase the use of SNSs when individuals are able to go online. If people use the event and content recorder to regulate their FoMO when they check records, they may encounter large volumes of events and content recorded. This could lead to a fear of missing information due to a large volume of information or periods of social media usage increasing in length despite decreasing in regularity. In support of this idea, individuals cutting down on smoking smoke fewer cigarettes but smoke each

cigarette for longer, thus reducing the benefit gained from smoking fewer cigarettes. Thus, this solution may reduce FoMO but not social network addiction. However, the former issue (FoMO due to large volume of information) can be corrected by personalising the recorded content according to individuals' preferences.

V. CONCLUSION

In this paper we studied how the functionalities of SNSs contribute to triggering FoMO in certain contexts of usage. While SNS features may not be deliberately designed to trigger FoMO and encourage greater interaction, they may, under certain other contexts of use, inadvertently trigger it. Also, we presented several mechanisms that can help to combat FoMO and discussed challenges that could be encountered when such mechanisms are applied. Our future work will be to provide countermeasures for FoMO (both social and technical); e.g. online peer support groups [24] in order to increase digital wellbeing for SNS users.

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