

Eye-tracking to assess social anxiety-related attentional biases and behaviours on social media likes and comments

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Abstract

Within the growing body of social media research, research has shown that young people with higher levels of social anxiety may use social media differently, though much of this evidence relies on self-report and cross-sectional designs. This experimental study used eye-tracking with adolescents and emerging adults (N=105) on a simulated social media site to examine cognitive attention biases to online social information (e.g., likes and comments) as potential mechanisms linking social anxiety and social media use. Results showed that in emerging adults (18-25 years), higher levels of social anxiety predicted increased attention to the number of likes and comments on a social media post. Among adolescents (13-17 years), these attention differences were not found, though behavioural differences were observed for social media interactions for those with higher levels of social anxiety. These findings suggest that developmental differences in cognitive biases associated with social anxiety are also evident in online contexts, with implications for identifying cognitive mechanisms underlying social media use.

Keywords: social anxiety; eye-tracking; social media; adolescents; attention bias; online behaviour; cognitive mechanism

1. Introduction

Adolescents are using social media as a way to actively communicate and connect with others, either through direct messaging and video-calling, or through interacting with others asynchronously via social media posts (Ofcom, 2023). Survey data within the UK indicates that 93% of 12- to 15-year-olds, and 97% of 16- to 17-year-olds are using social media apps or sites (Ofcom, 2023). This usage has increased from previous years, with 44% of 11- to 15-year-olds and 87% of 16- to 17-year-olds using social media platforms in 2021. It is also understood that individuals under the age of 25 are using social media platforms more than any adult age group (Ofcom, 2024a; 2024b). Popularity of the different social media apps differed across adolescent age groups (Ofcom, 2022; 2023), with Instagram, and TikTok remaining popular with both 12- to 15-year-olds (44% and 46%, respectively) and 16- to 17-year-olds (80% and 87%, respectively).

Due to the popularity of social media platforms increasing, research over the past decade has sought to understand how these platforms might have positive and negative effects on youth social interactions, mental health, and wellbeing. Systematic reviews discussing the relationship between depression, anxiety, and time spent on social media have indicated that the literature on this has been conflicting (Keles et al., 2020). Where a relationship between social media use and poorer mental health has been found, the link between these variables is small (Ferguson et al., 2022; Ivie et al., 2020; Orben & Przybylski, 2019). Research has also argued that social media use is an indicator of poorer mental health, opposed to a risk factor for future mental health concerns (Beeres et al, 2021) and that there may be indirect pathways between social media and mental health (e.g., through poor sleep and body dissatisfaction), indicating the complexity of this relationship (Kelly et al., 2018)

Social anxiety (also referred to as social phobia) has been as specific focus of recent social media research. As defined by the DSM 5, social anxiety is a fear of social situations in which the individual is exposed to scrutiny by others. These situations may include social interactions (e.g., meeting new people), performance-based interactions (e.g., delivering a talk), or being observed by others (e.g., eating in front of others, American Psychological Association, 2013) and so are particularly relevant to the public social approval features which are a common feature of social media platforms. Research has indicated that socially anxious individuals have a preference for

online interactions over in person interactions due to their greater perceived control over their self-presentation on social media in comparison to face-to-face encounters (Caplan, 2007; Hutchins et al., 2021).

Despite individuals with social anxiety feeling more comfortable online, people with higher levels of social anxiety tend to engage in fewer online social interactions (e.g., posting updates/ photographs) and have fewer social connections (e.g., Facebook friends) than people with lower levels of social anxiety (Weidman & Levinson, 2015). Moreover, fear of negative evaluation exists both offline and online, whereby negative evaluation or rejection fears have been identified as mediators between social anxiety and compulsive social media use (Ali et al., 2021). Further, research supports that individuals with higher social anxiety are more likely to engage in problematic social media use (e.g., reporting compulsive or excessive use of social media and experiencing withdrawal when not using social media; Casale & Fioravanti, 2015; Dempsey et al., 2019; Piko et al., 2024). Given these findings, it is important to note that those with higher levels of social anxiety may interact with online platforms differently, compared to those with lower levels of social anxiety.

Much of the past research has explored direct relationships between time spent on social media and social anxiety. However, the evidence of this has been contradictory (see systematic reviews of Dobrea & Pasarelu, 2016; Seabrook et al., 2016). In fact, 'screen time' is no longer seen to be a key factor that explains the relationship between social media use and social anxiety. Instead, it is important for researchers to look more specifically at behaviours online, as well as the wider social and environmental context (O'Day & Heimberg, 2021). For instance, socially anxious individuals are more likely to engage in passive social media use (e.g., scrolling or browsing through a social media feed), opposed to active social media use (e.g., posting content, or interacting with content, Shaw et al., 2015).

In addition to the need to explore how people are engaging with social media, the methods within the field of social media research need to be improved. First, many studies rely on correlational (e.g., Keles et al., 2019) and cross-sectional designs (e.g., Griffioen et al., 2020); therefore, causality or underlying mechanisms of behaviour cannot be inferred. Second, much of the research uses self-report measures of social media use (Griffioen et al., 2020), which is understood to be vastly different to logged digital media use (Parry et al. 2022). Due to these

limitations, it is important that researchers utilise objective, experimental measures to further the understanding of social media use.

With the emergence of eye-tracking, an objective measure of social media behaviour is possible (Vraga et al., 2016). Eye tracking research methods have been used to understand attention on social media, for example, attention patterns of individuals viewing fake news on social media (Simko et al., 2019) and attention towards emotional comments on social media (Kohout et al., 2023). This is helpful because researchers are able to move beyond relying on self-report measures of social media use, and by exploring attention differences they begin to highlight the underlying mechanisms associated with social media behaviours. Elias et al. (2021) also used eye tracking techniques with those using social media and found socially anxious individuals favoured social pictures less than individuals with lower social anxiety. One explanation of this could be related to the in person attentional avoidance biases associated with social anxiety being replicated within social media social interactions; however, this needs further exploration.

Traditionally, research has focused on Facebook use (Frost & Rickwood, 2017). Yet, other platforms are growing in popularity (e.g., Instagram, Ofcom, 2024b). It is important that researchers focus on elements of social media that can be generalised across platforms to ensure that the research remains relevant after updates or changes to the social media platforms (Parry et al., 2022). Reactions are social functions used across these platforms that allow users to engage and interact with the content and communicate with other users to varying degrees of complexity. Reactions can be measurable, closed actions (e.g., likes and shares), and it is typical that each post will show how many other users have reacted in a particular way (Hayes et al., 2018). Reactions can also be through open text by commenting on social media posts. In a survey by NHS Digital (2021), 16.7% of 11- to 16-year-olds who use social media reported that the number of reactions they received had an impact on their mood, with girls being more likely to report this than boys (21.1% versus 12.1%, respectively). Research has begun to experimentally explore the use of social media reactions on mental health, including how this may relate to self-esteem (Diefenbach & Anders, 2021) and emotional distress (Lee et al., 2020). MRI studies have also explored the brain responses of using and receiving likes and other peer feedback on social media (Sherman et al., 2016; 2018) with findings indicating that adolescents viewing social media images with a high number of likes showed greater activity in the brain

areas associated with reward processing and social cognition. This highlights the importance of further research exploring how adolescents view and interact with online interpersonal feedback (i.e., social media reactions).

Given research findings and media attention linked to negative outcomes from the pressures of gaining likes on social media, in 2021, Meta (owners of Facebook and Instagram) introduced new features to protect users by removing or hiding the number of likes on social media posts. This was introduced to depressurise the social media experience (Instagram, 2021). Research has begun to examine how hiding likes might influence social media behaviours. Prichard et al. (2021) examined how adult women felt about removing likes from social media posts. They found that the majority of women were in favour of the removal and believed that this would decrease negative comparisons and competitiveness to others. In contrast, research has shown that adolescents were not interested in hiding the number of reactions (Rides et al., 2024). Research has not yet experimentally evaluated how not having access to reaction information may influence social media behaviour.

In trying to understand the links between social anxiety and social media reactions, it is important to consider how research relates to the theoretical cognitive framework associated with social anxiety. We understand that cognitive biases are involved in the development and maintenance of excessive social media use (Turel & Serenko, 2020) and are present when individuals view social media comments (Dent & Martin, 2023). When reviewing the cognitive biases associated with social anxiety (Spokas et al., 2007), it could be theorised that these biases may help us to understand how socially anxious individuals behave whilst using reactions online. Cognitive-behavioural models have indicated that individuals with social anxiety have increased attention to perceived negative information, especially if the information highlights the presence of negative social evaluation (Rapee et al., 2023). This process may be replicated in the digital realm, with social media reactions (e.g., peer feedback) being a strong indicator of social status (Diefenbach & Anders, 2021), and with negative or 'trolling' comments (i.e., when someone comments online to deliberately upset others) acting as an indicator of negative social evaluation. The bias of interpretation suggests that individuals with social anxiety are more likely to interpret ambiguous social information as negative or threatening (Stuijzand et al., 2018). This could also link to the use of reactions online as we know that communication online is more ambiguous

than offline information due to the lack of non-verbal cues on social media (Miers et al., 2020). This may lead to a greater interpretation bias when socially anxious individuals are trying to understand ambiguous comments or have hidden likes on social media.

While the above cognitive behavioural models of social anxiety have been shown in adults, developmental researchers have proposed that these cognitive biases may not apply to children. Reviews of the evidence around the threat interpretation for children with anxiety indicate that there is mixed evidence for attention bias, and it is argued that attention biases become more noticeable in anxious young people at later stages in their development (Rapee et al., 2023). In fact, eye tracking studies with children and adolescents who have anxiety have not supported evidence of a bias toward threat (Lisk et al., 2020). It is important to assess if there are differences in attention on social media for older and younger adolescents depending on their levels of social anxiety.

Within the growing body of social media research, findings have begun to indicate how individuals with higher levels of social anxiety are using social media differently to those with lower levels of social anxiety. However, in recent years there has been a call for research to move beyond self-report, cross-sectional designs. The present study used an experimental design, with attention measures to understand the role attention biases may play in the relation between feelings of social anxiety and social media use. Measures of depression and generalised anxiety were also assessed to control for these within the analysis, due to co-morbidity to social anxiety (Koyuncu et al., 2019). Further, much of the previous research has focused on adults. As it is now understood that adolescence reaches 25 years, after brain maturation (Arain et al., 2013), the present study will focus on two groups of adolescence. We explored our research questions separately for two groups of adolescents: first, with mid-adolescents (13-18 years), which for clarity here we refer to the group as adolescents; second, with older adolescents, which for clarity here we refer to the group as emerging adults (18-25 years). By examining the 13-25 year age range, we are able to evaluate how attention on social media might differ with age. Different mental health measures for adolescents in schools were used compared to the emerging adult university sample to ensure the selected measures were recommended for these age groups. Lastly, we focus on understanding social media engagement, by exploring how young people attend to and may use information on the reaction of others who viewed the same content as

them. By identifying attention-related mechanisms driving social media use in socially anxious youth, this study may help shape evidence-based strategies to support healthier online engagement and reduce vulnerability to mental health challenges.

To imitate a typical social media experience, participants viewed a mock social media site, which contains social media posts with manipulated numbers of likes (absent, low, and high) and types of comments (positive, negative, and ambiguous). They were asked if they want to 'like' the social media posts (or not), whilst their attention was measured. This project will consider how does attention to the reactions of others (e.g., likes and comments) differ depending on feelings of social anxiety when deciding to like on a social media app for adolescents and emerging adults? It is predicted that when making a decision to like a social media post, adolescents with higher social anxiety will spend more time proportionally looking at the like information on social media posts.

2. Methods

Ethical approval was granted by the institutional Research Ethics Committee, and the lead researcher had an enhanced Disclosure and Barring Service (DBS) check. All participants gave opt-in consent to take part in the project, and parents and guardians of children between the ages of 13 and 16 also provided informed consent for this project.

2.1. Participants

2.1.1. Adolescents

Seventy-three adolescents participated (Range = 13-17 years, $M = 15.23$ years, $SD = 1.36$; Male = 21, Female = 49, Third gender = 2, Prefer not to say = 1). Participants identified as White ($n=54$), Asian/Asian British ($n=12$), Mixed or Multiple ethnic groups ($n=4$), Black, African, Caribbean, or Black British ($n=2$), and from an other ethnic group ($n=1$). Sixty-seven adolescents were recruited through four schools, where the researcher attended each school to carry out collect the data. Six adolescents were recruited via word of mouth and local poster advertising.

We aimed to collect a similar or greater sample than those reported in previous publications that have used eye tracking. Based on a review by King et al. (2019) of eye-tracking research in the

top communication and science journals, the average sample was 74 participants in these studies, which was similar in the present study.

2.1.2. Emerging Adults

Thirty-two emerging adults (Range = 18-25 years, $M = 20.70$ years, $SD = 1.91$; Male = 7, Female = 21, Third gender = 4) participated in the study. Participants identified as White ($n=18$), Asian/Asian British ($n=7$), Mixed or Multiple ethnic groups ($n=4$), Black, African, Caribbean, or Black British ($n=1$), and from an other ethnic group ($n=2$), and were recruited through the undergraduate Royal Holloway Research Participation Scheme. To compensate for their time, participating students received study credits or a £10 voucher.

2.1.3. Sample Size: Post-hoc sensitivity analysis

An a priori power analysis was not conducted for this study, however a post-hoc sensitivity analysis was used instead for both age group samples (Perugini et al., 2018). For adolescents, with a sample of 73 ($\alpha=.050$, $power=.8$) we can identify an effect size of $f=.10$ (considered a small effect size). For emerging adults, with a sample of 32 ($\alpha=.050$, $power=.8$) we can identify an effect size of $f=.3$ (considered as a small to medium effect size).

2.2. Materials

For both age groups participants completed identical tasks (social media task with eye tracking) and were assessed on similar constructs. Where measurements differed, due to age appropriateness (anxiety, depression, and social anxiety) this is outlined below.

2.2.1. Social Media Task

The experimental task was created using PsychoPy 3.0 experiment builder (Peirce et al., 2019). Before beginning the study, the researcher told participants that their research lab is looking to research new social media features, and want to see how young people interact with these tools by assessing attention. Participants began the task by creating a social media profile by choosing a username and profile colour. This was included to give the participant the sense that they are on a social media platform, thus enhancing the likelihood that they would behave in line with how they typically would on social media. Participants experienced 88 standard trials during the task. Prior to the image being shown, a fixation cross appeared on the screen for three seconds.

Participants then viewed the post and were asked ‘Do you want to like this post?’. The participant provided a keyboard response. If the participant wished to like the post, they would press the key with the green sticker. If they did not want to like the post, or to skip to the next trial, they would press the key with the red sticker. In line with typical social media use, the image was presented for as long as the user required, before making their decision and moving on. When pressing the ‘like’ button, an animated red heart appeared, with the message ‘You liked this post!’. If the participant pressed the ‘no like’ button, the task moved onto the next trial.

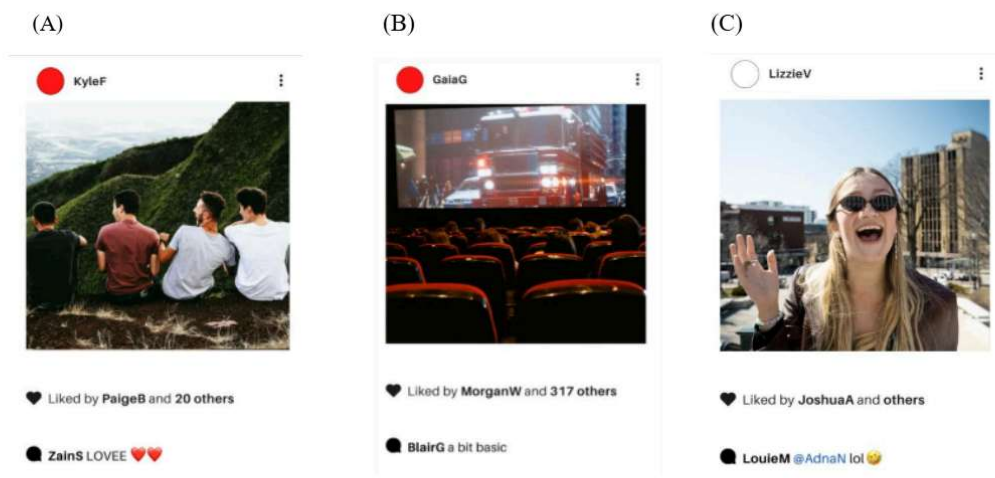
2.2.2. Social Media Posts

The 81 social media posts were created by the lead researcher using www.cavna.com. The posts were set out similarly to Instagram posts (including selfies, group images, and other images such as of animals, nature or artwork to reflect typical content). Each ‘post’ showed a username, an image, number of likes, and one comment (see Figure 1 for example stimuli). The comments were categorised into ambiguous comments (e.g., ‘Humm...’), positive comments (e.g., ‘LOVE! So creative.’), and negative comments (e.g., ‘You could stop trying so hard...’).

Each participant saw 27 images with numbers of likes missing (e.g., JohnS and others liked this post), 27 images with a low number of likes (between 2-20 likes, e.g., JohnS and 11 others liked this post), and 27 images with a high number of likes (between 200-350 likes, e.g., JohnS and 250 others liked this post). Nine versions were created so that each image was produced with each number of like and comment classification to control for image effects. In line with previous literature (Sherman et al., 2016), an additional 8 images were included with intermediate numbers of likes (between 50-150 likes) to avoid suspicion of the large difference between low number of likes and high number of likes. The data associated with these additional images were not included within the analysis. In addition to this, participants were told by the researcher that approximately 400 other young people had been liking and commenting on the posts. This allowed participants to judge if the image had a high number of likes, considering that approximately 400 people had viewed the post.

Figure 1

Example social media post stimuli: (A) is a 'group' photo, low number of likes, and a positive comment, (B) is an 'other' photo, high number of likes, and negative comment, and (C) is a 'selfie' photo, no number of likes information, and an ambiguous comment.



2.2.3. Eye-tracking

Whilst viewing the images, attention was monitored by a Tobii Nano Pro eye-tracker (a screen-based eye tracker, sampling gaze data at 60 Hz). Prior to starting the social media task, the eye-tracker was calibrated using the Tobii eye-tracker manager to ensure correct seating position, and a 5-point calibration took place within PsychoPy. Three areas of interest were selected within PsychoPy; the like information, the comment, and the image. The like and comment information was formatted to be further apart from each other to ensure that the area of interest (AOI) was correctly identified. See Figure 2 for image with AOIs highlighted.

Figure 2.

Example of social media image with areas of interest (image, likes, and comment) framed by a box around each AOI.



2.3. Measures

All questionnaires were administered on Qualtrics survey software (Qualtrics, Provo, UT) and took place after the participant took part in the social media task to ensure that these questionnaires did not create salient feelings of anxiety or influence the mood of participants. Age, gender, and ethnicity were collected to understand the demographic characteristics of the participants. Participants also reported the frequency of their social media use, and their typical online activities, the social media applications they use. In the pre-registration, the design plan also included preference for online social interaction (Caplan, 2007) and Brief Fear of Negative Evaluation scale (Leary, 1983), which participants responded to in line with the procedures outlined in Caplan (2007) and Leary (1991); however, in this sample, the internal consistency for these two scales was poor ($=.51$) and questionable ($=.60$), respectively, and therefore it was decided to remove these measures from the analysis.

2.3.1. *Depression and Anxiety*

Adolescents, 13-17 years, completed the Brief 11-item version of the Revised Children's Anxiety and Depression Scale for Adolescents (RCADS-11, Radez et al., 2021) where they judged the frequency of anxiety and depression symptoms from four options: 'Never', 'Sometimes', 'Often'

and, 'Always'. There were two subscales, where five items relate to depression (e.g., I feel sad or empty) and six items relate to anxiety (e.g., When I have a problem, my heart beats really fast). Questionnaire items were summed for the anxiety (score range 0-18) and depression (range 0-15) subscales, with higher scores reflecting more frequent symptoms of anxiety and depression. The RCADS-11 has shown acceptable/good internal consistency for clinical and community samples ($= .70-.94$, Radez et al., 2021) and good internal consistency in this sample ($= .88$).

Emerging Adults, 18 to 25 years, completed the Patient Health Questionnaire 8-item (PHQ-8; Kronke et al., 2009) to assess depression symptoms and the Generalised Anxiety Disorder scale (GAD-7, Spitzer et al., 2006) to assess anxiety symptoms. In these scales, they were judged on the frequency of depression (e.g., Little interest or pleasure in doing things) and anxiety symptoms (e.g., Feeling nervous, anxious or on edge) from four options: 'Not at all', 'Several days', 'More than half the days', and 'Nearly every day'. Questionnaire items were summed for the anxiety (range 0-21) and depression (range 0-24), with higher scores reflecting more frequent symptoms of anxiety and depression. The PHQ-8 has been shown to have good internal consistency in non-clinical samples ($= .82$, Pressler et al., 2011), and acceptable internal consistency in this sample ($= .76$). The GAD-7 has been shown to have good internal consistency ($= .89$, Löwe et al., 2008), and good internal consistency in this sample ($= .83$).

2.3.2. Social Anxiety

Adolescents, 13 to 17 years, social anxiety was measured using the Social Phobia Subscale of the Revised Children's Anxiety and Depression Scale (Social Phobia RCADS, Chorpita et al., 2000) where they judged the frequency of social anxiety symptoms (e.g., I feel afraid if I have to talk in front of my class) from four options 'Never', 'Sometimes', 'Often' and 'Always'. Responses were summed, and range from 0-27, with higher scores indicating higher levels of social anxiety. The RCADS Social Phobia Subscale has been shown to have good internal consistency in non-clinical samples ($= .86$, Donnelly et al., 2019), and good internal consistency in this sample ($= .87$).

Emerging adults, 18 to 25 years, social anxiety was measured using the Albany Panic and Phobia Questionnaire, social phobia subscale (APPQSP; Brown et al., 2005) where they judged how fearful they are of social scenarios (e.g., I feel afraid if I have to talk in front of my class) from nine options ranging from 'No fear' to 'Extreme fear'. Responses were summed, and range from

0-80, with higher scores indicating higher levels of social anxiety. The APPQSP has been shown to have good internal consistency ($=.87$, Brown et al., 2005), and good internal consistency in this sample ($=.82$).

2.4. Procedure

This study was preregistered on the Open Science Framework (https://osf.io/umbyt/?view_only=c2ae468ff06e4c428808254b0c3d3a6d). Prior to starting the study, the participants read the information sheet and provided consent to take part. Participants were also verbally reminded of their right to withdraw from the study at any time by the lead researcher. Participants were told that they had been invited to participate in this project as the researchers were collaborating to test out some new social media features and wanted to investigate how young people interacted with them, and what they thought and felt whilst using the social media platform. The researcher also explained to participants that for this stage in the research, we are interested in 'liking', not commenting, therefore after viewing the post, they will be asked if they wish to like the post. Participants were reminded that the green button was for 'yes, I want to like this', and the red button was for 'no, I don't want to like this'. Participants were reassured that the red button was not a 'dislike' button, this button was to indicate that they wanted to 'skip to the next post'.

Participants were asked to get comfortable and sit at a comfortable distance in front of the laptop where they could rest their hands on the response keys. They then took part in a 5-point calibration. After the eye-tracker had been calibrated, the participant worked through the social media posts, choosing to like or not like the post. For all participants the social media task was completed first to avoid demand characteristics of completing the anxiety, depression, and social anxiety scales may have on responding. Once the participant had completed the social media task, the researcher asked them to complete the questionnaires about their thoughts and feelings. On completion of the questionnaires, the participant was fully debriefed on the aims of the study, was reminded about their right to withdraw, and was asked if they had any remaining questions. Participants took between 30-40 minutes to complete the study.

2.5. Design & Analysis

2.5.1. Planned analysis

The study utilised a mixed model experimental design. To assess how attention to the engagement of others (e.g., likes and comments) differed depending on feelings of social anxiety when deciding to like on a social media app, we completed a series of generalised linear mixed effect (GLME) models to analyse categorical and frequency data and linear mixed effect (LME) models to analyse continuous data with the *glmmTMB* and *lme4* packages in R (Bates et al., 2015; Brooks et al., 2017). The outcome variables were the number of fixations and the average duration of the fixations on the like AOI. The predictor variables were the like condition of the post (absent likes, low likes, and high likes; absent likes was the reference condition) and social anxiety score. Symptoms of generalised anxiety and depression were controlled in the models. To account for variability of attention between participants and the image on the social media post, participants and the social media image were included as random intercepts for each model.

2.5.2. Exploratory analysis

Exploratory mixed effect models were conducted to understand differences in liking behaviour (i.e., whether participants chose to like the post) depending on the like condition of the post and scores on social anxiety, with general anxiety and depression scores being controlled for.

In addition, exploratory mixed effect models were conducted to understand differences in attention to the comments on the social media post when deciding to like the post. The outcome variables were the number of fixations and duration of the fixations on the comment AOI. The predictor variables were the comment condition of the post (negative, ambiguous, and positive tone; ambiguous tone was the reference condition) and social anxiety score. Generalised anxiety scores and depression scores were controlled in the models.

Further mixed effect models were conducted with the outcome variable of whether participants chose 'yes' or 'no' to like the post. The predictor variables were the like condition of the post (absent likes, low likes, and high likes; absent likes was the reference condition) and social anxiety score. Generalised anxiety and depression were controlled in the models.

Interaction effects between like and comment condition and social anxiety were included in the models however it was found that this was not significant for emerging adults (like condition*social anxiety $p=.955$, like condition*social anxiety $p=.332$) and adolescents (like

condition*social anxiety $p=.181$, like condition*social anxiety $p=.254$), therefore the models without these interactions are included here as these were best fitting.

3. Results

3.1. Data Processing and Descriptive Information

Five adolescents and two emerging adults were removed from the analysis for not completing the task correctly, errors within eye-tracking calibration or measurement, and incorrect saving of data. The eye-tracking data and self-report files were merged into one file for analysis. The eye-tracking data contained duration per fixation, and this was summed to calculate the total length of time that the participant viewed the areas of interest per trial. As this data was not normally distributed, a Yeo-Johnson transformation was performed to normalise the data (Yeo & Johnson, 2000). Due to high correlation between anxiety and social anxiety within the adolescent sample ($r = .79$), and large eigenvalues indicated within the model, the anxiety scores were removed from the model to ensure the best fit of the model using this sample.

The R code used for the planned and exploratory analysis, cleaned data set, and descriptive statistics on the frequency and type of social media usage is available on the OSF page (https://osf.io/92zga/?view_only=a9840772525c4d679a0d03c23fc3c7b8)

Means (SDs) of the measures and bivariate Pearson correlations between the measures are presented in Table 1. Summaries of the planned analysis is presented in Table 2 and the exploratory analysis is presented in Table 3 and Table 4.

Table 1

Pearson bivariate correlations and descriptives of measures for the two participant groups.

	Mean (SD)	1.	2.	3.	4.
Adolescents					
1. Depression	6.74 (3.50)				
2. Anxiety	7.55 (4.01)	.68***			
3. Social Anxiety	15.65 (6.22)	.66***	.80***		
4. Number of fixations to AOI	2.28 (1.50)	.02	-.01	.01	
5. Mean Duration of fixations to AOI	0.25 (0.22)	.03	-.02	.002	.83***
Emerging Adults					
1. Depression	7.69 (4.54)				
2. Anxiety	7.62 (4.71)	.78***			
3. Social Anxiety	27.62 (12.89)	.42***	.54***		
4. Number of fixations to AOI	1.99 (1.35)	.06	.16	.50**	
5. Mean duration of fixations to AOI	0.22 (0.22)	.03	.19	.46**	.90***

p<.01; *p<.001; AOI was like information on image

3.2. Results of Planned Analyses

For adolescents, social anxiety did not predict attention differences on the number of likes and mean duration when participants were asked if they would want to ‘like’ the social media post. However, when exploring the final model further, it was found that when the social media posts had a high number of likes, it was associated with an increase in the number of fixations on the likes on the social media post ($p = .050$).

For emerging adults, experiencing higher social anxiety significantly predicted greater frequency (Cohen’s $d = 0.33$, 95% CI [0.11, 0.55]) and duration ($R\text{-squared} = 0.08$) of attention on the number of likes when deciding whether they wanted to like the social media posts. The number of likes on the social media post did not predict attention differences.

In the analysis for both the adolescents and emerging adults, depression and general anxiety did not predict any attention differences (see Table 2).

3.3. Exploratory analysis: Attention to comments and liking behaviour

For adolescents, social anxiety did not predict attention differences on the comments when participants were asked if they wanted to 'like' the social media post. However, comment tone predicted both the frequency and duration of fixations for adolescents. Compared to ambiguous comments (used as the reference category in the model), positive comments were associated with a decrease in the number of times they looked at the comments (Cohen's $d = -0.08$, 95% CI $[-0.15, -0.02]$), while negative comments were associated with an increase in the number of times (Cohen's $d = 0.10$, 95% CI $[0.03, 0.16]$) and how long they looked at the comments (R-squared = 0.01). Further, experiencing higher social anxiety predicted a greater likelihood to say 'yes' to liking a social media post after accounting for depression and anxiety (Cohen's $d = 0.38$, 95% CI $[0.02, 0.75]$).

For emerging adults, having higher social anxiety significantly, positively predicted how long (R-squared = 0.07), but not how frequently, they looked at the social media comments. Further, when exploring emerging adults' attention to the comments when making decisions to like a post, LME analysis showed that comment tone (negative, ambiguous, or positive) predicted both the frequency and duration of fixations for emerging adults. Compared to ambiguous comments (used as the reference category in the model), positive comments were associated with a decrease in the number of times they look at the comments (Cohen's $d = -0.12$, 95% CI $[-0.22, -0.02]$) and in how long they look at the comments, while negative comments were associated with an increase in how long they look at the comments (R-squared = 0.01). Further, in contrast to adolescents, when reviewing the likelihood of emerging adults 'liking' the social media posts, the analysis indicated no variables included in the model significantly predicted if they were to say 'yes' or 'no' to liking a social media post.

See results presented in Tables 3 and 4.

See Figure 2 for a gaze map indicating the fixations on the social media images.

Figure 2

Gaze map showing an example of attention across a social media image.

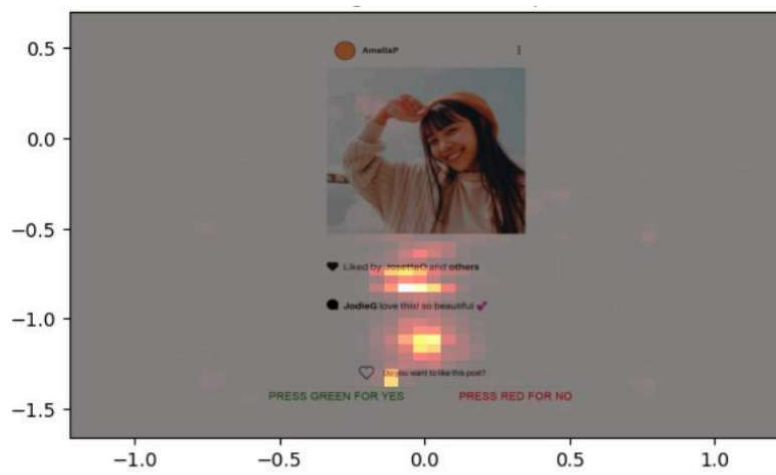


Table 2.

Summary of the planned linear mixed effect models on the frequency and duration of fixation on likes (LME and GLME).

	Frequency of fixations on likes						Duration of fixations on likes					
	Adolescents			Emerging Adults			Adolescents			Emerging Adults		
	β	SE	z	β	SE	z	β	SE	t	β	SE	t
Social Anxiety	0.002	0.01	0.14	0.03	0.008	2.95**	-0.0004	0.005	-0.09	0.009	0.003	2.67*
Depression	0.01	0.03	0.51	-0.03	0.03	-1.002	0.005	0.008	0.58	-0.02	0.01	-1.24
Anxiety	-	-	-	0.004	0.04	0.10	-	-	-	0.009	0.01	0.60
Like Condition (low likes)	0.02	0.03	0.83	-0.02	0.05	-0.49	0.02	0.03	0.66	-0.0002	0.02	-0.01
Like Condition (high likes)	0.03	0.03	0.88	-0.02	0.05	-0.46	0.03	0.03	0.80	0.005	0.02	0.29

*p< .05; **p<.01

Table 3.

Summary of exploratory linear mixed effects models on the frequency and duration of fixation on comments (LME and GLME).

	Frequency of fixations on comments						Duration of fixations on comments					
	Adolescents			Emerging Adults			Adolescents			Emerging Adults		
	β	SE	z	β	SE	z	β	SE	z	β	SE	z
Social Anxiety	-0.002	0.015	-0.15	0.02	0.01	1.64	-0.004	0.006	-0.79	0.01	0.004	2.32*
Depression	0.04	0.03	1.41	-0.004	0.04	-0.09	0.01	0.001	1.25	-0.01	0.02	0.56
Anxiety	-	-	-	-0.02	0.04	-0.40	-	-	-	0.006	0.02	0.34
Like Condition (low likes)	-0.003	0.03	0.11	-0.12	0.12	-1.00	-0.005	0.01	-0.38	-0.02	0.02	-1.01
Like Condition (high likes)	-0.05	0.03	-1.73	-0.19	0.12	-1.56	0.02	0.01	-1.62	-0.02	0.02	-0.92
Comment Condition (Negative)	0.10	0.03	3.10**	0.08	0.05	1.59	0.09	0.04	2.45*	0.07	0.02	3.09**
Comment Condition (Positive)	-0.08	0.03	-2.60**	-0.12	0.05	-2.36*	-0.02	0.04	-0.64	-0.06	0.02	-2.89**

Note: The reference categories were 'absent likes' and 'ambiguous comments'

* $p < .05$; ** $p < .01$

Table 4.

Summary of exploratory linear mixed effects models on the decision whether to 'like' the social media image (GLME).

	Decision to like (1=yes, 2=no)					
	Adolescents			Under 18		
	β	SE	z	β	SE	z
Social Anxiety	0.06	0.03	2.00*	>-0.01	0.02	-0.45
Depression	0.001	0.06	0.02	-0.02	0.07	-0.29
Anxiety	-	-	-	>0.01	0.08	0.02
Like Condition (low likes)	0.19	0.22	0.89	-0.12	0.28	-0.44
Like Condition (high likes)	0.08	0.22	0.38	0.09	0.27	0.32
Comment Condition (Negative)	-0.07	0.08	-0.87	0.19	0.11	1.69
Comment Condition (Positive)	0.23	0.08	0.29	0.10	0.12	0.84

Note: The reference categories were 'absent likes' and 'ambiguous comments';

* $p < .05$

4. Discussion

The present study explored attention differences whilst adolescents decided if they wished to 'like' (social media reaction) a series of posts on a mock social media site. The aim of this research was to further understand the attention patterns of adolescents and emerging adults, using objective measures of attention on social media, and to consider how this links to social anxiety. This research was particularly focused on whether individuals with higher social anxiety attended differently to the posts perceived as more or less popular by others, compared to those with lower social anxiety. In line with the hypothesis, for emerging adults, levels of social anxiety predicted increased attention to the number of likes (post popularity) when deciding

whether or not to 'like' social media posts. However, for adolescents, these attention differences were not found.

Exploratory analyses were also conducted on the attention to the comments on posts of the mock social media site. This analysis indicated a similar pattern to attention to post likes, whereby emerging adults with higher social anxiety were likely to attend more frequently to the comments section for a post when deciding whether to like a post, while this difference was not found for adolescents. Interestingly, the tone of the comments influenced attention for both age groups; when the comment had a negative tone there was greater attention to the comment section compared to an ambiguous tone. Exploratory analyses also investigated the participants' decision making regarding whether they wished to 'like' the social media post. Higher levels of social anxiety in adolescents predicted a greater likelihood to say 'yes' to liking a social media post (regardless of the like information presented), whereas this difference was not observed with emerging adults.

These findings relating to social anxiety and attention differences for emerging adults support cognitive models of social anxiety, which propose that individuals will have an attention bias to perceived socially threatening information from their environment (Hope et al., 1990); this is often referred to as hypervigilance. Attention biases are typically found when perceived threatening information is related to the presence or chance of negative social evaluation (Spokas et al., 2007). We understand that the number of likes on social media are not inherently threatening and they may be objectively neutral, individuals with high social anxiety may interpret this information through a negative lens due to attention and interpretation cognitive biases. As a result, social evaluative cues like 'likes' may be perceived as signals of social judgment. This interpretation may influence the decision to conform with social expectations and 'like' the post on social media in order to avoid any potential negative social consequences (Rides et al., 2024). Notably, this attention bias for social anxiety was consistent, regardless of if the likes were high, low, or no number was associated with the likes, suggesting a generalised sensitivity to social evaluative cues rather than a valence-specific response. This has interesting implications for the newer developments on social media, such as Instagram and Facebook introducing the option to 'hide' the number of likes on social media posts seen on the feed. This feature was introduced to help provide a more relaxed environment online without having to

view the number of likes on a post (Instagram, 2021). Yet, the findings from this study indicate that young people's attention to the likes on social media posts do not differ when the number of likes is hidden, therefore this new feature may not have the desired effect.

In contrast, the attention biases for those with higher social anxiety were not reflected in the adolescent sample in this study. This finding is related to the alternative anxiety models for children discussed earlier in this paper, with researchers arguing that the attention biases seen in adults with higher anxiety will not be observed in adolescents until approximately 18 years old (Jenness et al., 2021). This is supported by the findings of the present study, where attention biases were only seen in the emerging adults. Further research could build on this work by longitudinally exploring if these age differences are also seen when measuring other cognitive processes in social anxiety (e.g., self-perception, working memory, and reinforcement learning) when interacting with a mock social media site. Understanding processes will assist in the development of improved explanatory models of the interaction between mental health and social media.

In line with the social anxiety literature for adolescents, we would expect young people with higher levels of social anxiety to pay more attention to the like information on social media, as they are more likely to engage in comparison behaviours, especially with greater opportunities for this on social media (Fardouly et al., 2020; Rapee et al., 2022). Yet, the findings of this research does not support this. This could be explained by younger adolescents not interpreting the like information on the social media post as important social information for their decision. Alternatively, this might be a form of social information avoidance bias also seen in those with high levels of social anxiety, where those with higher levels of social anxiety seek or attend to less information about social situations than those with lower levels of social anxiety (Thyagaraj et al., 2025). Interestingly, and a limitation of this study, is that participants were interacting with a mock social media platform where the reactions of others were not from people that they were familiar with. This may have reduced attention to the reactions on the social media posts for socially anxious individuals given their tendency to prefer feedback from close or familiar others opposed to strangers (Thyagaraj et al., 2025). It is expected that if the younger adolescents had used their own social media accounts, they would be looking more towards the social information on the platform (e.g., the number of likes) to see which of their peers had interacted

with the post. The younger sample in this study were of school age, therefore they are more likely to use social media to interact with people they know (Ofcom, 2023) and therefore interacting with a mock social media site that contained unknown names would not have been a realistic experience for them. Whereas we understand that emerging adults use online platforms to connect and develop friendships with people they do not know (Ofcom, 2023; Pew Research Centre, 2015). Therefore, emerging adults viewing unfamiliar users on the mock social media site would not be as different to their typical social media experience. Future research could build on this work by understanding attentional differences on likes while participants' scroll on their own social media account.

To further understand the information processing differences seen in the eye-tracking findings, further exploratory analysis on the participants liking behaviour were conducted to understand if behavioural differences are also present. Higher levels of social anxiety in younger adolescents predicted a greater likelihood to say 'yes' to liking a social media post, with this relationship was constant, no matter if the likes were high, low, or no number was associated with the likes. Whereas for older adolescents there were no behavioural differences observed. These findings might relate to younger adolescents with social anxiety wanting to get the 'correct' answer, to avoid possible scrutiny from others (Rapee et al., 2023). The findings from this study suggest that younger adolescents with social anxiety do not exhibit an attentional bias toward the number of likes. Instead, because likes are generally perceived as positive feedback on social media, individuals with higher levels of social anxiety may be liking posts not based on the social content they have observed, but rather as part of a social script aimed at avoiding potential negative consequences of not liking posts (Rides et al., 2024).

In addition to the likes on the social media posts, one comment was also included on the post and were phrased to either be positive, negative or ambiguous. This was manipulated to understand if the comment phrasing predicts attention differences towards the comments when users are deciding to like the post. For both age groups, the findings showed that a negative tone predicted greater attention to the comments compared to an ambiguous tone. This is supported by research by Kohout et al. (2023) who found a similar negativity bias towards comments on social media posts with university students, where visual attention was higher for negative comments compared to positive comments. Understanding that people will spend more time

looking at negative comments, thus more time on posts that have negative comments, has implications for understanding what content is being prioritised by social media algorithms. If young people are focusing more on negative comments online, it is possible that they are more likely to be exposed to negative and harmful content. With the introduction of 'Teen Accounts' for Instagram and Facebook (Meta, 2024), there will be some restrictions on the harmful content that young people will have access to (e.g., content that promotes self-harm or eating disorders); however, the findings of this study also highlight the importance for social media companies to further adapt their algorithms to ensure negative comments are removed, and not prioritised. Future research may explore how young people interact with these new accounts, especially how they attend to the reactions on the posts.

The negativity bias in this study's findings was present regardless of levels of social anxiety, however, it is important to note that this task only asked participants if they wanted to like the post, therefore we may expect differing findings if participants were also asked to comment on the post. Future research could explore this further by examining attention differences when liking and commenting on social media posts.

4.1. Clinical implications of findings

The findings support that developmental differences in cognitive biases associated with social anxiety are evident in online contexts. Although this study used a non-clinical sample, future research should investigate whether the relationship between social anxiety cognitive biases and online interactions differs for individual levels of social anxiety in the general population and clinical levels of social anxiety.

Nevertheless, digital research methods, like those used here, means that we can experimentally explore social information processing more easily. This opens up new possibilities for understanding how attentional and other cognitive biases interact in social anxiety disorder and determine how these relationships contribute to more comprehensive explanatory models of the disorder. Importantly, examining these processes in online environments adds to our understanding of social processing in-person. This knowledge can help clinical formulations and improve the specificity of psychological interventions by targeting the cognitive mechanisms most relevant.

4.2. Strengths and Limitations

The use of a controlled, experimental design for this study allowed the researchers to move beyond the limitations associated with self-reported social media use (Parry et al., 2022) to objectively measure social media behaviours on a mock social media site. Moreover, the eye-tracking measures provided a unique insight into adolescents' attention differences whilst using social media. However, we recognise that taking an experimental approach such as this does not capture the entire social media experience (e.g., online interactions with friends, switching between different social media apps, or how online behaviours change throughout the day), which should be taken into account when interpreting these findings. Future studies may add to this research by using experience sampling methodology to understand how the use of social media reactions may change throughout the day and how this might link to mental health concerns.

4.3. Conclusion

The findings from this study highlight the importance for researchers to consider objective measures for understanding how young people with anxiety disorders interpret and engage with online platforms. Previous research in this area has made inferences on what information social media users attend to when making decisions based on self-report measures, with previous work suggesting that younger social media users with higher levels of anxiety are focusing on likes (Burrow & Rainone, 2017); yet, the eye tracking data in this study has indicated that this is not always the case. Future research could explore this further by using objective measures of social media behaviour to understand the underlying cognitive mechanisms and behaviours online.

In conclusion, the present study indicates that the number of likes on social media posts are important sources of information that young people use when deciding to like on a social media post. This is seen particularly with older adolescents who are experiencing higher levels of social anxiety, who may have an attention bias towards this information. In contrast, this attention bias was not observed in younger adolescents with higher social anxiety, yet behavioural differences indicated that younger adolescents with higher levels of social anxiety were more likely to like a social media post regardless of the number of existing likes on the post. The findings from this study highlight that those with mental health concerns, particularly individuals with higher social anxiety, are more likely to interact differently with reactions on social media. This adds an

important contribution to the current research on social media, as it increases understanding on how reactions contribute to the cognitive mechanisms underlying social media use.

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