Computers in Human Behavior 138 (2023) 107464

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

"Thinstagram": Image content and observer body satisfaction influence the when and where of eye movements during instagram image viewing

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ARTICLE INFO

Keywords:
Body satisfaction
Eye movements
Instagram
Self perception
Social comparison
Social media

ABSTRACT

Selective Exposure Theory (Aruguete & Calvo, 2018; Bigné et al., 2020) suggests that on social media, viewers pay most attention to content which aligns with their values and preferences. Individuals engage in self-assessment by comparing themselves to others (Social comparison theory: Festinger, 1954). We predicted that the characteristics of Instagram arrays and participants' own body satisfaction would combine to influence their visual processing of computer-based images. A 3 (Body Shape: Underweight, Average, Overweight) × 2 (Body Part: Face-only; Body-only) repeated measures design was used. We recruited 60 (young) women to view arrays of images as displayed on Instagram [M_{age} = 20.75 years, SD_{age} = 2.74 years]. A separate, naïve group of 37 participants rated 165 stimulus images on a scale of under-to-over-weight. These normed images were used to create artificial, ecologically-valid 3 × 4 Instagram image arrays containing two of each type of stimulus image. We recorded participants' eye movements with a high degree of spatial and temporal resolution while participants freely engaged with these arrays. We then collected participants' body satisfaction data (Slade et al., 1990). Results demonstrated inter-relationships between eye movement behaviour and Body Shape, Body Part, and body satisfaction. In short, both bottom-up stimulus characteristics and top-down satisfaction impacted measures of processing. Image content was particularly relevant to 'when' measures of processing time, whereas body satisfaction was more-influential upon 'where' measurements (fixations counts, number of visits per stimulus image). Our study is the first of its kind to show such effects. Future research is needed to understand such effects in clinical and/or non-female users of Instagram and other platforms.

1. Introduction

With social media platforms growing in popularity and becoming increasingly image-rather than text-based, users are increasingly likely to be exposed to potentially damaging images (Saiphoo & Vahedi, 2019). Younger female users may be particularly vulnerable to engaging in upwards social comparison when viewing idealized, filtered images of other women online (de Vries et al., 2016). This can negatively impact users' views of their own bodies, as well as having other negative mental health consequences, and in some cases could lead to maladaptive behaviours such as eating disorders (e.g., Mabe et al., 2014). For these reasons it is vital that we gain a further understanding of how such images are consumed by female users. In this study we recorded the eye movements of female Instagram users while they viewed arrays of images containing face and body images pre-tested to represent 'underweight', 'average', and 'overweight' females. By analysing eye movement behaviour together with participants' own self-reported body satisfaction, we can determine which social media images potentially vulnerable female users look at for longer, and more intensely, and how this may be driven by their own self-perceptions.

1.1. *Instagram & social comparison*

Instagram is a highly visual, image-based social media platform which was launched in 2010 and has since been taken over by Facebook (now Meta; Marengo et al., 2018; Twenge et al., 2019). Unlike its parent company's main platform, it has always been primarily photo- rather than text-based. Users can share pictures to their main feed or share temporary 'stories' which are visible for 24 h. Over 1000 photos are uploaded to Instagram every second (Aslam, 2021). Because of its visual

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https://doi.org/10.1016/j.chb.2022.107464
Received 18 April 2022; Received in revised form 11 August 2022; Accepted 25 August 2022
Available online 30 August 2022

content, Instagram presents a more authentically social experience and elicits more feeling of intimacy in users than text-based sites (Pittman & Reich, 2016).

Despite this façade of authenticity, as on all social media sites, images posted on Instagram are often idealized (Saiphoo & Vahedi, 2019). Compounding this, Instagram has inbuilt features which allow the altering and enhancement of photos, e.g., the application of filters, before they are shared. Over 2/3rds of Americans reported editing some aspect of a photo before uploading it to social media (Jain, 2017). Around 18% of all photos on Instagram are edited and the type of images most often edited are selfies (Pettersson, 2017).

Different types of images are perceived differently online: selfies are popular (Sung et al., 2016) and teenage users view manipulated selfies more positively than the unmanipulated originals (Kleemans et al., 2018). An increasingly prevalent phenomenon on Instagram is the rise of influencers (Djafarova & Duckworth, 2017). These are typically young, attractive women who use the site to promote messages or products for monetary gain, presenting these messages as authentic personal narratives (Abidin, 2016). Perhaps due to the visual nature of Instagram it contains a lot of sexualized imagery (Deighton-Smith & Bell, 2018; Guizzo et al., 2021).

Instagram currently has over 1 billion active users worldwide (Mohsin, 2021), a majority of whom are female (Aslam, 2021) and over two thirds of user are under 34 years old (Statistia, 2021). Seventy-two percent of teenagers use Instagram with a quarter saying it is their preferred social media site (Aslam, 2021) and motives for Instagram use are primarily to promote social interactions (Blight et al., 2017; Sheldon & Bryant, 2016). Research has focused on the impact of site-use on users and social media has often been linked to positive psychological outcomes for users (e.g., social connectedness: Allen et al., 2014; self-affirmation: Toma & Hancock, 2013), especially image-based platforms (Pittman & Reich, 2016). However, some more recent studies also highlight a link to negative outcomes (self-objectification: Feltman & Szymanski, 2018; body image disturbance: de Vries et al., 2016; risk of developing eating disorders: Mabe et al., 2014) which may be due to idealized images driving potentially harmful social comparisons (Marengo et al., 2018).

The process by which individuals assess and understand themselves in relation to others in known as Social Comparison Theory (Festinger, 1954). Comparisons can occur in three directions: upwards (when an individual perceives themselves as being inferior to a target on a particular dimension), laterally (when they perceive themselves as comparable to a target) and downwards (when they perceive themselves as being superior to a target). Individuals engage in social comparison for a variety of reasons, including self-assessment, self-improvement, self-enhancement, and self-verification (Taylor et al., 1995). Using social media has been found to promote more frequent upwards social comparisons, which are also more extreme, relative to face-to-face interactions (Fardouly et al., 2017).

There are several affordances on Instagram which suggest it may be especially likely to promote damaging upward social comparisons. One of the primary motives for using Instagram is surveillance and gathering knowledge about others, which may promote upwards social comparison (Sheldon & Bryant, 2016). There is some evidence that posting selfies may promote social comparison in users (Chae, 2017). Female images posted on social media – including by young female users themselves – are often idealized (and/or sexualized) which is likely to elicit appearance-based social comparisons in other females (Fardouly et al., 2015; Saiphoo & Vahedi, 2019).

Upward social comparisons have been associated with lower body satisfaction, particularly in females (Myers & Crowther, 2009; Tiggemann & Polivy, 2010). Female users are more likely than males to spend time looking at photos of others of the same sex (McAndrew & Jeong, 2012) and are more likely to use social media to engage in social comparison (Saiphoo & Vahedi, 2019). Although Instagram use has been linked to psychological benefits, such as higher wellbeing and lower loneliness, this was only for users who did *not* engage in social comparisons (Mackson et al., 2019).

1.2. Body dissatisfaction and harmful consequences

Social comparison directly links to body satisfaction (Rodgers et al., 2015), even when the comparison is not focused on physical appearance (Tiggemann & Polivy, 2010), a relationship which is mediated by participants' own physical attractiveness (Hendrickse et al., 2017). While it has been suggested that focus on physical appearance and fashion could actually have body-positive consequences for social media users (Webb et al., 2017), increasing self-satisfaction due to exposure to plus-size models (Clayton et al., 2017; Slater et al., 2017), there is little evidence to support this, and most existing research has focused on exposure to images of underweight or idealized female images.

Facebook use was found to correlate with body image disturbances in a meta-analysis of 14 studies (Frost & Rickwood, 2017), while users of both Facebook and Instagram have reported decreased body satisfaction and increased negative affect compared to non-users (Casale et al., 2019; Engeln et al., 2020). In an experimental study, young female Instagram exposed to either unfiltered or enhanced selfies rated the edited ones more positively, but those who saw the enhanced images reported lower body satisfaction, particularly when they demonstrated high social comparison tendencies (Kleemans et al., 2018). Images can negatively impact users' self-impressions no matter the status of the pictures' subject (e.g., friends vs. celebrities controlled for attractiveness: Brown & Tiggemann, 2016). Even when idealized images are qualified by accompanying comments their negative impacts are not nullified (Fardouly & Holland, 2018).

The impact of (reduced) body satisfaction can be severe, and triggers on social media which lower body satisfaction can impact behaviours as well as cognitions (e.g., desire for cosmetic surgery: de Vries et al., 2014; cosmetic surgery intentions: Guizzo et al., 2021). Appearance-based upwards social comparisons, particularly with friends, can lead to dieting behaviour (Rancourt et al., 2015). Body image disturbance is classified as a cognitive-emotional distortion and is common in individuals with eating disorders (e.g., Cash & Deagle, 1997). If an individual has an eating disorder and they are exposed to body images over a period, this will lead to negative cognitions and emotions, creating a harmful cycle (Hilbert, Tuschen-Caffier, & Vogele, 2002; Tuschen-Caffier et al., 2003).

Individuals with eating disorders typically consider themselves to be 'fat and unattractive' and are unhappy with the physical appearance of their bodies. They also engage in compulsive behaviours such as checking themselves in the mirror or body measuring (Stice, 2002; Tuschen-Caffier et al., 2003). Two disorders associated with social comparison, and specifically with Instagram use, are bulimia and anorexia (Rajan, 2018; Turner & Lefevre, 2017), serious conditions from which many patients do not recover (Russell et al., 2019). These are usually accompanied by depression, anxiety, and loneliness (Schlegl et al., 2020), and have been linked to sleep disturbance in young adults (Nagata et al., 2021). They cause patients to employ more dysfunctional emotional regulation strategies, which can lead to a cycle in which harmful behaviours are increased (Meule et al., 2021). In extreme cases eating disorders can cause sufferers to engage in self harm and suicidal behaviours (Cliffe et al., 2020; Perkins et al., 2020), and even in those who do not intentionally self-harm, premature death due to medical complications is relatively common (Russell et al., 2019). Individuals suffering from eating disorders hold attentional bias to appearance-related stimuli (Williams et al., 1996). By measuring attention, it is possible to assess what aspects of stimuli individuals (including social media users) are focusing on, and thus what cognitions are driving their behaviour.

1.3. Eye-tracking and social media

Eye-tracking is an unobtrusive, spatially accurate, temporally sensitive, online method of measuring visual attention consisting of dynamic saccades and static fixations (Rayner, 1998; Vraga et al., 2016). Fixations are indicators of overt attention: both longer fixation durations and higher number of fixations are indicators of increased cognitive load, with duration of gaze related to processing difficulty and fixation frequency associated with viewer interest (Fitts et al., 1950; Jarodzka et al., 2013; Rayner, 1998).

Eye-tracking is increasingly used to investigate how social media users interact with platforms (e.g., Scott & Hand, 2016). Researchers typically look at viewing patterns by dividing the screen into Areas of Interest (AoIs) and measuring how many fixations viewers make in that area, and for how long they fixate. AoIs are subjectively defined, including content which differs between platforms and studies. Gaze patterns in novel online environments are thought to be guided by the visual hierarchy model (Faraday, 2000) which posits two cognitive processes as drivers: initial searching (for a 'point of entry') and subsequent scanning (for relevant information round the entry point). As well as salient features of the page, viewers' own perspectives and motivations can also influence viewing patterns in a top-down way (Pashler & Harris, 2001; Pravettoni et al., 2008). Selective Exposure Theory (Aruguete & Calvo, 2018; Bigné et al., 2020) suggests that on social media, viewers pay most attention to content which aligns with their values and preferences.

When viewing pages which contain pictures, or a combination of text and pictures (such as Instagram) eye movement patterns are unpredictable, with participants initially searching for a salient entry point (Rayner, 2009). Viewers' attention is likely to be attracted by variable bottom-up features (e.g., image content, attractiveness: Lindholm et al., 2021; Seidman & Miller, 2013), as well as top-down influences (e.g., motivation, personal value: Badenes-Rocha, Bigne, & Ruiz, 2022; Scott & Hand, 2016).

On Instagram, users are typically familiar with the layout of posts on a timeline, but within individual posts of search results, which are typically presented as a selection of images in a 3 × 4 on-screen array, there is no consistent entry point. While users may be considered expert due to their familiarity with the overall layout, when presented with a selection of images for the first time such stimuli should be considered novel. It is likely that as well as being influenced by bottom-up perceptual features contained in the images, when viewing Instagram arrays viewers will also be driven to attend to images related to their preferences and values (Bigné et al., 2020), and this will be reflected in the frequency and duration of their eye movements (Aruguete & Calvo, 2018).

1.4. Eye-tracking and body image

Eye-tracking has been used to investigate how women view their own bodies, as well as the bodies of others, and the cognitions behind these behaviours in healthy individuals as well as individuals with lower body satisfaction and eating disorders. When viewing a photo of themselves, healthy individuals selectively focus attention on body regions that are self-reported as attractive, whereas body satisfaction is a predictor of selective attention to self-reported unattractive regions (Bue, 2020; Glashouwer et al., 2016; Smeets et al., 2011). Frequency of using Instagram is associated with attention to high-anxiety body areas, and social comparison and body satisfaction have been shown to be mediators in this effect (Bue, 2020). When looking at images of other individuals the pattern is reversed: healthy participants focus on the body regions of others that they consider 'ugly', while individuals with symptomatic eating disorders focus on the 'beautiful' body parts of others (Jansen et al., 2005).

Two recent studies have specifically focused on how female Instagram users view images of women on the site. Bue and Harrison (2020) had young adult female participants view thin-ideal Instagram images presented alongside wither comments which idealized the image, or disclaimers which criticised it as unrealistic. There was no difference in gaze duration on the model across conditions, and participants' self-reported body anxiety and perceived social pressure for thinness did not differ across conditions. Gaze time on the model's thighs increased with participants' thigh-specific body anxiety in both conditions, but gaze time on the model's waist increased with waist-specific anxiety only when the photo was paired with an idealized comment, suggesting that disclaimer comments were partly effective.

Manas-Viniegra et al. (2019) had participants – females under 25 years old who identified as 'curvy' – view Instagram images of curvy models promoting fashion brands while wearing either swimwear or street clothes. Curvy models attracted more attention than thin models, and when models were dressed in swimwear participants' attention focused on imperfect body areas (e.g., abdomen, skin folds in curvy models), whereas when they were dressed in street clothes attention focused on the fashion brands. This adds support to previous studies which have found that women focus on areas of others' bodies which they consider unattractive (e.g., Bauer et al., 2017; Svaldi et al., 2016). No study has yet compared female participants' gaze patterns when presented with both underweight and overweight female images, as well as 'average' baseline images.

1.5. The current study

In the current study, we used eye-tracking methodology to measure visual attention as female participants viewed face and body images of other women of varying body size. >We chose to focus specifically on female users as these not only represent the majority of Instagram users (**Aslam, 2021), but female users spend more time looking at same-sex pictures than males (McAndrew & Jeong, 2012), these pictures are more likely to be idealized or sexualized and lead to appearance-based comparisons and negative cognitions (Saiphoo & Vahedi, 2019; Tiggemann & Polivy, 2010**). We recorded participants' gaze as they viewed 3 arrays of twelve Instagram pictures (3 × 4) containing distinct face and body images of underweight, average, and overweight women. Participants' own body satisfaction was also recorded. We utilised eye movement measures to determine which type of images are focused on by female users, and how these users' own body satisfaction impacts their gaze on different categories of stimuli. By comparing these three different sizes of female body we will be able to determine which type of image participants are most 'attracted to' (i.e., find most compelling), and the interplay between external stimulus type and their own internal self-perceptions. We chose to include face as well as body images as a significant proportion of selfies consist of only an individual's face (Jennings, 2019). Such images contain cues as to the individual's weight, albeit more subtly than images depicting the torso, and no study has investigated the degree to which any weight-related attentional bias may extend to facial images.

We chose to examine four distinct eye movement measures: first-pass time (FP) – the sum total of fixation durations made in the participant's first visit to a region prior to fixating a different region; total fixation duration (TFD) – the sum total of any and all fixations made within a region of interest regardless of which visit to that region; fixation count (FC) – the number of legitimate fixations made within a region; and visit count – the number of saccadic visits (entries and re-entries) to each particular region of interest.; visit count (VC) – the number of unique 'visits' made to each AoI.

TFD (also referred to in some studies as 'dwell time') is considered indicative of bottom-up stimulus complexity and processing difficulty, while FC indicates top-down viewer interest, and both are commonly used in eyetracking studies investigating social media (e.g., Rayner, 1998; Scott & Hand, 2016). First pass was included to capture bottom-up processing during the initial search phase (Faraday, 2000). As the stimuli presented to participants are novel (although the layout of arrays are uniform in that they contain 3x4 images, the content is not so participants must fixate on each image to discover the contents) this represented how long they spend viewing each type of image and extracting information when they first view it. Visit count is more representative of top-down processing – once participants have viewed an image in the array and discovered what sort of image it contains this measures how often they return to view it to extract further information. we chose not to include as a measure an index of the order in which AoIs were viewed – this measure only provides an insight to the attention and cognition of participants when they are expert and viewing uniform stimuli with which they are familiar (e.g., Facebook timelines where specific information such as the profile picture is always presented in the same location). In the current study the arrays presented to participants represent novel stimuli. As such, participants have no way of predicting what information, or type of image, will be present in which location, and analysis of the initial scan-oath will only provide information about the initial random searching phase where participants are looking for an 'entry point' from which to begin scanning (Faraday, 2000).

We predicted that we would find differences between eye movement behaviours on body part and body shape. Bodies contain more cues to weight so are likely to be looked at for longer and fixated on more often. We therefore predicted:

H1. Body-only images will fixated on more often, and for longer, than face-only images.

It is well established that thin, idealized images are considered more attractive by typical female Instagram users than average or unedited equivalent images (Kleemans et al., 2018). Therefore, we also expected that viewers would spend more time looking at these 'attractive' underweight images. Specifically, we predicted that:

H2. Underweight images will be fixated on for longer than overweight images.

We further anticipated a predictive relationship between body satisfaction scores and eye movement behaviours, dependent on both body shape and body part. We recruited typically healthy participants (i.e., who did not suffer from any eating disorder), they would be likely to view the areas of others that they find attractive. This would mean that they avoid looking at areas that cause them dissatisfaction with their own bodies, i.e., if they had lower body satisfaction, they would likely avoid looking at the 'attractive' underweight bodies of others. We therefore predicted:

H3. Participants with lower body satisfaction scores would fixate on underweight body-only images less often, and for a shorter amount of time.

H4. Participants with lower head satisfaction scores would fixate on underweight face-only images less often, and for a shorter amount of time.

As body images contain more cues to overall bodyweight than do faces, it was likely that these differences would manifest more strongly in the images of bodies than the images of faces. We therefore predicted that:

H5. : This difference would be greater for body-only images than for face-only images.

2. Method

2.1. Design and participants

A 3 (Body Shape: Underweight, Average, Overweight) × 2 (Body Part: Face-only; Body-only) repeated measures quasi-experimental design was used to explore participants' eye movement behaviours. Eye movement behaviour was additionally considered in relation to co-variates including participants' body satisfaction and body attitudes.

A total of sixty participants – biologically female and identifying as women – completed both the eye movement task and attitudinal survey [M_{age} = 20.75 years, SD_{age} = 2.74 years]. All participants were volunteers, had normal or corrected-to-normal vision; participants reported never having being diagnosed with a visual processing, attentional, or cognitive impairment. Fifty-six (93%) were Instagram account holders/users, whereas four were not (7%); these participants did report being familiar with the site. Participants were recruited via adverts on campus and on social media and were not compensated for their participation.

2.2. Materials and apparatus

2.2.1. Stimuli

Participants viewed three 3 × 4 photo arrays each containing two photos from each condition. These were presented as they would be displayed via Instagram on a mobile phone, with the 'home', 'search', 'reels', and 'shop' icons underneath. Photos were placed pseudo-randomly within the array and were counterbalanced. Thirty-seven independent female evaluators (M_{age} = 24.41 years, SD = 4.04), who did not participate in the final study, normed the stimuli. They were recruited via adverts on social media. These participants rated 165 images of female faces and bodies on a 7–point Likert-type scale of 'Underweight' (1) to 'Overweight' (7). Images included in the norming study were all publicly available on Instagram and were selected by the experimenters to represent a range of physical sizes. They were presented in a pseudo-random order via the survey software QuestionPro. The final set of stimuli (six from each category) received the following participant-perceived 'weight' ratings: Underweight Face (M = 1.77, SD = 0.28), Underweight Body (M = 1.64, SD = 0.16), Average Face (M = 4.08, SD = 0.41), Average Body (M = 3.97, SD = 0.13), Overweight Face (M = 6.23, SD = 0.35), and Overweight Body (M = 6.35, SD = 0.27).

2.2.2. Measures

The Body Satisfaction Scale (BSS; Slade et al., 1990) was used to determine participants' self-perception of their own body satisfaction. The BSS is composed of items representing 16 body parts, half involving the head (above the neck) and the other half involving the body (below the head/neck). Participants rated their satisfaction (or dis-satisfaction) with each of these body-parts on a seven-point scale (1 = very satisfied to 7 = very unsatisfied; 4 = undecided); thus, higher scores represent greater dis-satisfaction. The 16 BSS items are mapped onto three summative scales: "head" satisfaction – summing ratings for seven head items (head, face, jaw, teeth, nose, mouth) and eyes; "body" satisfaction – summing ratings for seven body items (shoulders, chest, tummy, arms, hands, legs, and feet); "general" satisfaction – summing ratings for all 16 body items. Slade et al. (1990) showed that, for a college student-type sample, the internal consistency of the 'head' (α = 0.803), 'body' (α = 0.785), and 'general' (α = 0.871) subscales showed good internal consistency.

2.2.3. Apparatus

Eye movements were recorded on a Tobii TX300 screen-based eye-tracker. The eye-tracker had a spatial resolution of 0.01° and eye position was sampled a was sampled at a rate of 300Hz while stimuli were presented on a 23 inch, 1920 × 1080 widescreen monitor. Stimulus presentation was controlled by Tobii studio on an Alienware laptop computer running an Intel core i7-3630QM CPU 2.40 GHz processor with 10 GM of RAM and an Intel HD 4000 graphics card. Viewing was binocular with eye movements recorded from the right eye.

2.3. Ethical considerations and procedure

The study was conducted in a bespoke eye-tracking lab on-campus. The study was designed and carried out according to the principles of the British Psychological Society (2014) and was approved by the School Ethics Committee. Participants were given oral instructions by the experimenter as well as viewing written instructions on screen. These included trigger warnings about the presence of underweight images of females faces and bodies. After giving consent, participants were told they would be presented with arrays of photos taken from Instagram and instructed to view each array for as long as they wished. Each array was preceded by a fixation cross in the centre of the screen and followed by a rest screen. After completing the eye-tracking task participants then completed the questionnaire before being thanked and debriefed. The study took approx. 10 min to complete.

2.4. Data analysis

Raw data was handled as per the standards and practices of similar studies (e.g., Scott & Hand, 2016). To explore the independent and combined effects of body shape and body part on participants' eye movement behaviour, a series of 3 × 2 repeated measures analyses of variance (ANOVAs) were performed. In general, all assumptions were met; however, the assumption of sphericity was broken on three occasions: for FC data, the main effect of Body Shape ($W = 0.785$, $p = .001$; $\varepsilon = 0.844$), and for VC data, both the main effect of Body Shape ($W = 0.856$, $p = .011$; $\varepsilon = 0.898$) and the Body Shape × Body Part interaction ($W = 0.880$, $p = .025$; $\varepsilon = 0.919$). In all three cases, Huynh-Feldt corrections were applied to degrees of freedom.

To explore the relationships between participants' eye movement behaviours and their self-reported body satisfaction and body attitudes, a series of Pearson's one-tailed correlations were conducted. Prior to running these analyses, scatterplots were inspected visually to understand whether there was any evidence of non-linear (i.e., bimodal) or curvilinear relationships between variables; no such evidence was found.

Finally, a series of stepwise multiple linear regressions were conducted to explore the predictive relationship between co-variates and eye movement outcomes – again, these were conducted globally across conditions, and broken down by shape and body part.

3. Results

3.1. ANOVAs

Descriptive statistics across eye movement behaviour measures, body shapes, and body parts are presented in Table 1. A summary of ANOVA results can be found in Table 2.

3.1.1. Body shape

The main effect of Body Shape was significant in every measure of eye movement behaviour. Analysis of FP data revealed that there was no difference between mean FP time on Underweight images (469 ms) and Average images (470 ms; $p>.999$); however, participants' mean FP time on Overweight images (406 ms) was shorter than either Underweight images ($p = .001$) or Average images ($p<.001$).

This general pattern was also found in TFD data – there was still no significant different between TFD for Underweight (781 ms) and Average images (831 ms; $p = .595$), and Overweight images (616 ms) received less TFD than either Underweight ($p<.001$) or Average images ($p<.001$).

Regarding FC data, the pattern was slightly different – Underweight (25.93) and Average images (27.39) received on average the same number of fixations ($p = .334$), and Overweight images did not receive more fixations than Overweight images on average (23.73; $p = .306$); indeed, the only significant difference among body shapes within FC data was that Overweight images received on average fewer fixations than Average images ($p = .002$).

In terms of VC data, the data was again different – Average images (18.40) were visited, on average, more times than Underweight images (16.83; $p = .002$) and Overweight images (15.68; $p<.001$); however, there was no significant difference between visits to Underweight images and Overweight images ($p = .175$).

3.1.2. Body part

The main effect of Body Part was significant across eye movement measures. In all measures, figures received longer processing times and more fixations/visits than faces (FP: 490mss vs. 407 ms; TFD: 835 ms vs. 651 ms; FC: 27.63 vs. 23.74; VC: 17.78 vs. 16.16).

3.1.3. Body shape × body part interaction

Across all eye movement measures, the interaction between Body Shape and Body Part was significant. A summary of the simple main effects of Body Shape for figure images and face images across measures is presented in Table 3.

When considering images that featured bodily figures only, fixation duration measures (FP, TFD) showed that participants spent less time fixating Overweight figures than Underweight or Average figures (which did not differ from one another). In terms of FC data, participants made more fixations on Underweight figures than Average or Overweight figures (which did not differ from one another).

When considering images that feature faces-only, in the FP measure, participants spent on average less time looking at Underweight faces than Average or Overweight faces (FP for faces of Average and Overweight images did not differ). When we consider TFD, the pattern is somewhat different; participants showed longer TFD on Average faces than either Underweight or Overweight (which did not differ from each other). This pattern was reflected in fixation and visit data – for FCs, participants made more fixations on Average faces than Underweight or Overweight (which did not differ from each other), and VC data showed that participants made more visits, on average, to Average faces than Underweight or Overweight faces (which again did not differ from one another).

3.2. Correlations

We considered the relationship between participants' eye movement

Table 1
Mean (standard deviation) values and 95% Confidence Intervals for eye movement measures across conditions.

	Figure-only			Face-only		
Under		**Average**	**Over**	**Under**	**Average**	**Over**
FP	566 (27)	513 (20)	389 (13)	372 (13)	426 (15)	422 (14)
TFD	998 (56)	862 (49)	643 (34)	564 (34)	799 (42)	589 (32)
FC	931 (14)	827 (13)	625 (12)	521 (10)	728 (13)	523 (11)
VC	919 1(7)	818 1(7)	617 1(7)	515 1(5)	719 1(7)	514 1(5)
Under		**Average**	**Over**	**Under**	**Average**	**Over**
FP	[507,1625]	[461,565]	[356,422]	[339,405]	[388,464]	[388,458]
TFD	[855,1142]	[737,988]	[557,730]	[476,652]	[691,908]	[507,672]
FC	[827,1635]	[724,930]	[522,728]	[418,623]	[624,931]	[520,626]
VC	[817,1620]	[716,920]	[515,719]	[414,617]	[617,921]	[513,616]

Note. Figures rounded to nearest whole number.

Table 2
Main effects of body shape, body part and their interaction across measures.

	Body Shape			Body Part			Shape × Part		
	F	p	η_p^2	F	p	η_p^2	F	p	η_p^2
FP	10.989	<.001	.157	30.110	<.001	.338	29.612	<.001	.334
TFD	19.405	<.001	.247	32.361	<.001	.354	21.362	<.001	.266
FC	5.603	[!]008	.087	19.648	<.001	.250	19.548	<.001	.249
VC	12.155	[!!]<.001	.171	15.790	<.001	.211	14.426	[!!!]<.001	.196

Note. [!] = Huynh-Feldt degrees of freedom applied (1.69, 99.57); [!!] = Huynh-Feldt degrees of freedom applied (1.80,106.00); [!!!] = Huynh-Feldt degrees of freedom applied (1.84,108.43); all other degrees of freedom for Body Shape (2,118), Body Part (1,59), and interaction (2,118).

Table 3
Simple main effects of Body Shape by image type (figure, face) across measures.

	Body Part	Under vs. Average		Under vs. Over		Average vs. Over	
Image	Measure	Diff.	*p*	Diff.	*p*	Diff.	*p*
Figure	FP	53	.108	177	<.001	124	<.001
	TFD	136	.086	355	<.001	219	<.001
	FC	4	.011	6	.001	2	.239
	VC	1	.622	1	.293	1	>.999
Face	FP	−53	.011	−50	.010	3	>.999
	TFD	235	<.001	25	>.999	210	<.001
	FC	−7	<.001	−2	.684	5	.002
	VC	−4	<.001	1	.387	5	<.001

Note. Diff. = mean difference, rounded to nearest whole number. Fixation durations differences in msec. FC/VC as number of fixations/visits.

behaviours and their responses to the head, body, and general dimensions of the BSS (Slade et al., 1990). The results of a series of Pearson's one-tailed corrections on global data (collapsed across stimulus body shapes and body parts) are summarised in Table 4.

FP data did not correlate with measures of body satisfaction. However, TFD and FC correlated negatively with participants body satisfaction (body and head) – participants who reported lower body satisfaction spent less time looking at the contents of the images in our arrays and made fewer fixations within these regions of interest. The number of visits to the regions correlated negatively with body satisfaction – lower VCs were associated with lower body satisfaction.

Given significant Body Shape × Body Part interactions on eye movement measures, we considered correlations between attitudinal measures and eye movements broken-down by shape and part (n.b., FP is not considered, given its lack of relationship with BSS dimensions, and similarly, General Satisfaction is not considered given its lack of relationship with eye movement measures; see Table 4). A summary of key relationships is presented in Table 5.

In short, participants' body satisfaction was particularly related to gaze aversion away from images pre-tested as Underweight or Average [n.b. *higher* scores in the BSS indicate *less* satisfaction]. As participants' head satisfaction decreased, the less time they spent looking at Underweight images, and the fewer visits they made to Underweight and Average images. In general, participants with lower head satisfaction engaged less with our array images. As participants' figure satisfaction decreased, the less time they spent looking at Average images, and the fewer visits they made to Underweight and Average images. In general,

Table 5
Pearson's correlations (one-tailed; *n* = 120) – body shape and image type.

	Head Satisfaction	Figure Satisfaction
TFD – Underweight	−.183*	−.129
TFD – Average	−.113	−.218**
TFD – Overweight	−.108	−.119
TFD – Figure	−.134*	−.172*
TFD – Face	−.144*	−.137*
FC – Underweight	−.258**	−.253**
FC – Average	−.184*	−.249**
FC – Overweight	−.140	−.082
FC – Figure	−.239**	−.253**
FC – Face	−.152*	−.141*
VC – Underweight	−.274**	−.320**
VC – Average	−.178*	−.242**
VC – Overweight	−.145	−.112
VC – Figure	−.224**	−.262**
VC – Face	−.168*	−.186**

Note. * = *p*<.05, ***p*<.01.

participants with lower figure satisfaction engaged less with our array images.

3.3. Regressions

We performed regression analyses globally, taking forward candidate predictors based on prior general linear model and correlational analyses. Covariates which reached $p<.10$ in correlational analyses were considered as candidates for multivariate models following the recommendations of Bursac et al. (2008), suggesting typical significance limits (e.g., $p\leq.05$) may fail to determine significance among dimensions otherwise known to be predictive. Pre-checks suggested that assumptions (i.e., multicollinearity, independence of error terms, non-zero variances, normality, homoscedasticity, and linearity) were satisfied. Across eye movement measures, stepwise methods were followed. Models are summarised in Table 6.

As a crude summary, our processing duration measures (the 'when') suggest that Body Part (face-only vs. body-only) and Body Shape (particularly, pre-rated 'Overweight' images) influenced participants' visual attention. Typically, participants spent longer looking at 'bodies', and were gaze-averse to overweight stimuli (as rated by a separate cohort of naïve participants). In terms of the spatial measures (the 'where'), participants' own body satisfaction and the stimulus body part

Table 4
Pearson's correlations (one-tailed; *n* = 360) – global analyses.

	Mean (SD)	2	3	4	5	6	7
1. FP	448.2 (17.8)	−.687**	−.125**	−.009	−.021	−.034	−.003
2. TFD	742.7 (44.5)	–	−.672**	−.635**	−.134**	−.152**	−.005
3. FC	225.7 (12.4)		–	−.897**	−.195**	−.197**	−.037
4. VC	217.0 1(6.8)			–	−.196**	−.224**	−.002
5. Head Satisfaction	227.3 1(8.7)				–	.592**	−.083
6. Figure Satisfaction	231.9 1(9.9)					–	−.091*
7. General Satisfaction	257.1 1(6.9)						–

Note. * = *p*<.05, ***p*<.01.

Table 6
Summary of stepwise regressions – global analyses.

Outcome	Predictor(s)	R	R^2	R^2_{adj}	F	p	β	D-W
FP	Body Part						−.232	
	Overweight	.286	.082	.077	15.931	<.001	−.168	1.853
TFD	Body Part						−.207	
	Overweight						−.201	
	Figure Satisfaction	.326	.106	.099	14.135	<.001	−.152	1.963
FC	Figure Satisfaction						−.197	
	Body Part	.252	.064	.058	12.122	<.001	−.157	1.941
VC	Figure Satisfaction						−.224	
	Body Part	.254	.064	.059	12.305	<.001	−.120	1.801

Note: β = standardised coefficient. D-W = Durbin Watson value.

(face-only vs. figure-only) were the key determinants of eye movement behaviour; again, participants attention was captured by bodies rather than faces, and participants with lower body satisfaction engaged in less visual processing of stimulus arrays.

3.3.1. Regressions by body shape

Based on the results of the ANOVAs, we executed separate regressions to explore predictors of participants' eye movement behaviour in relation to each body shape. These are summarised in Table 7.

In the earliest FP measure, for Underweight and Average shapes, participants were more-likely to spend time processing figures respective to faces. Participants' body satisfaction did not factor into regressions into the later TFD measure, and was indeed a larger contributor to eye movement behaviours than Body Part when considering the spatial FC and VC measures. Overall, participants with lower body satisfaction were less-likely to engage with the stimulus arrays.

3.3.2. Regressions by body part

Based on the results of the ANOVAs, we executed separate regressions to explore predictors of participants' eye movement behaviour in relation to each body part image type (face-only, figure-only). These are summarised in Table 8.

Analyses revealed that the Body Shapes presented in the arrays were more influential in the 'temporal' (when) measures of processing – FP and TFD – and that participants were gaze-averse to the images that a previous group of participants had rated 'overweight'. Participants' own body satisfaction was more influential on the spatial (where) measures, and participants with lower body satisfaction dedicated less visual processing effort to the stimulus arrays.

4. Discussion

This study utilised eye movement measures to examine how female Instagram users viewed images of underweight, average, and overweight women on Instagram, and how viewing patterns were driven by users' own body satisfaction. Our analyses revealed differences in gaze patterns towards different categories of image and demonstrated evidence of both bottom-up and top-down drivers of eye movements. When discussing eye movement behaviours, we will make a distinction between eye movement measures which focused on the location of 'where' participants were looking within the stimulus array (i.e., Fixation Count and Visit Count), and temporal measures which described 'when' participants were looking at an image (i.e., First Pass and Total Fixation Duration).

4.1. Stimulus factors × body satisfaction

When analysing participants' eye movements, we saw an interaction between Body Shape and Body Part on all processing measures. For body-only images, 'where' and 'when' measures both suggest bias towards Underweight images, which were viewed for longer, and fixated on more often, than Average or Overweight images, partially supporting H_2. For face-only images, all measures suggested a bias towards Average faces, which were viewed for longer and fixated on more often than Underweight and Overweight images. This contradicts H_2 and can be explained by participants viewing the stimuli they considered most attractive: images of thin women on social media are considered more attractive than average or overweight alternatives (e.g., Kleemans et al., 2018), and bodies contain more cues relating to bodyweight than do faces presented in isolation (Coetzee et al., 2010). Conversely, it has been shown that average faces are considered more attractive than non-average faces by typical observers (e.g., Valentine et al., 2004) which in this context may operationalize as faces of Average 'weight' being viewed as more attractive than under- or over-weight extremes.

In general, figures were fixated more often, and for longer, than faces, supporting H_1. This could be related to the fact that torsos contain more weight-related cues than faces (Coetzee et al., 2010), suggesting that female users are more interested in images of other women's bodies

Table 7
Summary of stepwise regressions – shapes.

Outcome	Shape	Predictor(s)	R	R^2	R^2_{adj}	F	p	β	D-W
FP	Under	Body Part	.469	.220	.213	33.214	<.001	−.469	2.243
	Average	Body Part	.244	.059	.051	7.448	.007	−.244	1.938
	Over	–	–	–	–	–	–	–	–
TFD	Under	Body Part						−.428	
		Head Satisfaction	.466	.217	.203	16.187	<.001	−.183	2.253
	Average	Figure Satisfaction	.218	.047	.039	5.860	.017	−.218	1.883
	Over	–	–	–	–	–	–	–	–
FC	Under	Body Part						−.396	
		Head Satisfaction	.473	.223	.210	16.823	<.001	−.258	2.178
	Average	Figure Satisfaction	.249	.062	.054	7.832	.006	−.249	2.084
	Over	–	–	–	–	–	–	–	–
VC	Under	Figure Satisfaction						−.320	
		Body Part	.408	.167	.152	11.706	<.001	−.254	2.181
	Average	Figure Satisfaction	.242	.059	.051	7.353	.008	−.242	1.876
	Over	Body Part	.239	.057	.049	7.129	.009	−.239	1.647

Note: β = standardised coefficient. D-W = Durbin Watson value.

Table 8
Summary of stepwise regressions – body parts.

Outcome	Part	Predictor(s)	R	R^2	R^2_{adj}	F	p	β	D-W
FP	Figure	Overweight	.350	.123	.118	24.921	<.001	−.350	1.919
	Face		–	–	–	–	–	–	–
TFD	Figure	Overweight						−.278	
		Figure Satisfaction	.327	.107	.097	10.567	<.001	−.172	2.057
	Face		–	–	–	–	–	–	–
FC	Figure	Figure Satisfaction						−.253	
		Overweight	.299	.089	.079	8.688	<.001	−.159	1.628
	Face	Head Satisfaction	.152	.023	.018	4.230	.041	−.152	1.649
VC	Figure	Figure Satisfaction	.262	.069	.064	13.141	<.001	−.262	1.524
	Face	Figure Satisfaction	.186	.034	.029	6.347	.013	−.186	1.792

Note: β = standardised coefficient. D-W = Durbin Watson value.

than their faces as these are more indicative of 'idealized' slimness. This would also mean that such images are potentially more informative if viewers are going to engage in social comparison (Marengo et al., 2018).

We also analysed participants' own body satisfaction and found that this self-perception impacted upon some of the gaze measures: while image content seemed to be driving the 'when' measures of processing in a bottom-up manner, personal attitudes proved to be top-down predictors of the 'where' measures. Initial correlations showed that participants' gaze avoidance of underweight face and body images, evidenced by lower FC and VC, a measure of later top-down processing, was associated with satisfaction of these particular body parts. This supports H_3 and H_4 and demonstrates that while Instagram users' own self-perceptions are important in determining how they view online content, they are not the only relevant factors, and the presentation of stimuli on platforms can also determine both how and when stimuli are fixated.

Regression analysis further differentiated the impact of the bottom-up and top-down factors on the 'where' and 'when' measures. Overall, Body Part and Shape (particularly 'overweight' images) predicted participants visual attention on early, bottom-up FP measures. Body Part, Body Shape, and participants' own figure satisfaction impacted TFD. Participants' own body satisfaction and stimulus Body Part predicted visual attention on the 'where' measures (FC and VC). These results partially support H_5 and expand on previous studies which examined eye-tracking of female body images on social media (Bue, 2020; Bue & Harrison, 2020). Both of these studies measured TFD, one of the 'when' measures in the current study, and found that participants' own self-perceptions and body anxiety influenced gaze towards specific body parts. Results here are consistent with previous findings that participants' own self-perceptions direct attention to body parts of other women differentially based on their body shape, and highlight the role played by other bottom-up factors in gaze patterns. Stand-alone bottom-up processing seems to apply to the earliest measure of FP viewing time, while both bottom-up and top-down factors influence TFD. Top-down measures further influenced gaze duration and are more influential in the 'where' measures.

The differences observed here may be due to the more complex nature of the stimuli in the current study compared to previous studies, with images of female faces and bodies being presented in arrays of 12 at a time rather than individually. The increased complexity of the stimuli would require more bottom-up *and* top-down processing, but these impact on different stages of viewing. Participants use bottom-up cues from the pictures to gain an 'entry point' to the complex novel stimuli presented to them, from which to further investigate the stimuli (Rayner, 2009). This manifests in the FP measure, with top-down factors having more of an influence over later processing as participants become familiar with the images in front of them and attention is increasingly driven by personal values (Bigné et al., 2020).

While both 'where' and 'when' measures are associated with increased cognitive load, 'when' measures typically represent the processing difficulty of a stimulus, while 'where' measures are indicative of viewer interest (Fitts et al., 1950; Rayner, 1998). It is unsurprising then that the 'where' measures were most sensitive to participants' own self-perceptions, with FC and VC lower for individuals with lower body satisfaction. This shows avoidance from looking at high-anxiety body areas in line with previous findings (Bue, 2020; Bue & Harrison, 2020).

4.2. Bottom-up and top-down processing

As well as the distinction between 'when' and 'where' eye-movement measures, a key finding of the current study is the differential influence of bottom-up and top-down factors in determining how participants engage with the stimulus arrays. In our study, FP is a particularly salient measure of early, bottom-up processing, while VC represents later-top-down cognitions. In terms of bottom-up processing, the visual hierarchy model posits that gaze patterns in online environments are guided by features of the stimuli (Faraday, 2000), with bottom-up features capturing viewers' attention (e.g., Lindholm et al., 2021). This reflects the search for a salient entry-point from which to investigate a novel image more systematically (Rayner, 2009). Our results show differences in processing times due to both Body Shape and Body Part which demonstrate that attention was drawn to certain types of stimulus image over others.

The impact of top-down factors of participants' self-perceptions (i.e., body satisfaction) was seen in both the 'when' and the 'where' measures, demonstrating not only that these factors are important drivers of gaze, but that they impact early stages of processing. Previous research has shown that individuals' motivations and personal values influence viewing patterns (Pravettoni et al., 2008) and that this occurs when viewing social media stimuli (Badenes-Rocha et al., 2021; Scott & Hand, 2016). Particularly on social media, personal values are thought to be extremely important in guiding attention (Selective Exposure Theory: Aruguete & Calvo, 2018; Bigné et al., 2020). The pre-motor theory of attention (Rizzolatti et al., 1987) argues that observers covertly allocate attention prior to executing an overt eye movement. Our findings of top-down self-perception effects ('push cues') on early processing measures would fit with such a model of attention and eye movements; however, our findings also show the importance of stimulus-driven 'pull cues'.

These results suggest that female viewers' perceptions of their own bodies are typically of high personal importance and will guide visual attention while viewing images of others on social media, potentially as sources of information with which to engage in social comparison. This is especially likely on image-based social media platforms such as Instagram where one of the primary activities that users engage in is surveillance of others (Sheldon & Bryant, 2016).

The finding that bottom-up and top-down factors differentially impact observable measures adds weight to the theory that exposure to harmful images online, and negative cognitions, feed into each other, creating a harmful cycle that is difficult for individuals to escape from (Hilbert et al., 2002; Tuschen-Caffier et al., 2003). This relationship is known to exit in clinical populations with eating disorders where exposure to body images will lead to negative cognitions and emotions, which will in turn drive selective attention to harmful images (Cash & Deagle, 1997; Tuschen-Caffier et al., 2003). The way 'healthy' users engage with content on social media is known to influence the outcomes they experience. Users who viewed material on Instagram demonstrated measurable mental health benefits only if they did not engage in social comparison (Mackson et al., 2019). Users of Instagram may be particularly susceptible to falling into this trap as viewers' attention may be drawn to edited images which, although rated positively, are more harmful than unedited/unidealized images (Kleemans et al., 2018). Some researchers even suggested that downwards comparison could be triggered by exposure to overweight images, leading to improvements in mental health (e.g., Slater et al., 2017; Webb et al., 2017), although more research would be needed to confirm this.

4.3. Beyond the current research

The current study focussed on user exposure to images of female bodies exclusively on Instagram. It has been discussed how picture-based sites such as Instagram are potentially more damaging than more text-based social media platforms such as Facebook or Twitter (Saiphoo & Vahedi, 2019) but care should be taken not to generalize the results found here more broadly. Increasingly, social media is becoming more image-than text-based (Aslam, 2021). Snapchat is an example of a platform which allows users to share photos, but there are key differences between Instagram and Snapchat. First, Snapchat promotes the use of filters more than Instagram, and while these might not idealize an image, they will alter it (Hawker & Carah, 2021). Second, as well as sharing stories as per Instagram, the main function of Snapchat is for users to send images and messages to individual friends privately rather than broadcast them publicly (Vaterlaus et al., 2016). This means that users are more likely to be exposed to non-idealized images of close friends rather than idealized images of more distant acquaintances or influencers.

Launched in 2017, a relatively new addition to the social media landscape is TikTok. This platform has a typically younger user demographic (Montag et al., 2021). TikTok perhaps represents the next stage of social media evolution as it facilitates the sharing of short videos, from 15 s to 3 min long, rather than still photos (Statistia, 2021; Yang, Zhao, & Ma, 2019, July). Instagram represented a more authentic and intimate social media experience than text-based platforms such as Facebook (Pittman & Reich, 2016), so it is likely that the video-based TikTok will further increase feelings of authenticity and elicit even higher feelings of intimacy in users. While users, particularly younger users, may be drawn to the platform because of this, the primarily video-based content may be harder to alter and idealize than the static images which constitute most Instagram content. Therefore, young female users may be less exposed to the idealized images which generate harmful-comparison cognitions. More research is needed to assess the extent of exposure to idealized images of females on other social networking platforms and how this may trigger social comparison in female users.

While the current research focused exclusively on female users, recent research has shown that male users are also affected by body comparison issues (e.g., O'gorman et al., 2020). Future research could examine how male participants view images of underweight, average, and overweight faces and bodies, and compare viewing patterns between genders.

The current study has some limitations. As well as focusing exclusively on Instagram, we targeted a healthy population and measured only the body satisfaction of participants. Previous studies have shown that factors such as self-schema, self-discrepancy, and self-esteem may mediate the relationship between Instagram use and body satisfaction (Hendrickse et al., 2017). Future research should look to expand the current findings by focusing specifically on vulnerable populations, and by including other potential predictors of both downward comparison cognitions and maladaptive eating behaviours. The current study also involved only female participants. Even though female users spend more time looking at images of the same sex (McAndrew & Jeong, 2012), the impact of exposure to idealized and sexualized images of men on male participants should also be investigated, as eating disorders are a significant problem for males as well as females (e.g., Limbers et al., 2018). Finally, the stimuli used in the current study consisted of photos presented without any text. Previous studies have shown that, in some circumstances, comments presented alongside images can mediate gaze time to specific anxiety-related body parts (Bue & Harrison, 2020). Future research could focus more specifically on individual body parts rather than generalising to 'head' and 'torso', and also investigate the impact of text comments to the visual processing of pre-tested 'underweight', 'average', and 'overweight' images.

5. Conclusion

In conclusion, by measuring the eye movements of female Instagram users while they viewed stimulus arrays containing images of under-, average-, and over-weight female bodies and faces, we found differential effects of bottom-up and top-down factors. These manifested differently in 'where' and 'when' measures of eye movement behaviour. The bottom-up factors such as Body Part and Body Shape particularly drove the 'when' measures of eye movement, whereas participants' body satisfaction influenced 'where' measures in a top-down fashion. Participants selectively attended to bodies over faces and overall preferred Underweight and Average images to Overweight ones. Participants avoided looking at images which reflected their own areas of lower body satisfaction. These results provide insight into the mechanisms of a potentially dangerous cycle promoted by social media platforms; exposure to damaging images leads to upwards social comparison and as a result personal satisfaction in users. This in turn could promotes a perceptual bias to selectively attend to more-damaging stimuli.

CRediT author statement

Graham G. Scott: Methodology, Investigation, Supervision, Writing – original draft. **Zuzana Pinkosova:** Methodology, Conceptualization, Writing – review & editing. **Eva Jardine:** Methodology, Investigation, Software. **Christopher J. Hand:** Formal analysis, Writing – review & editing.

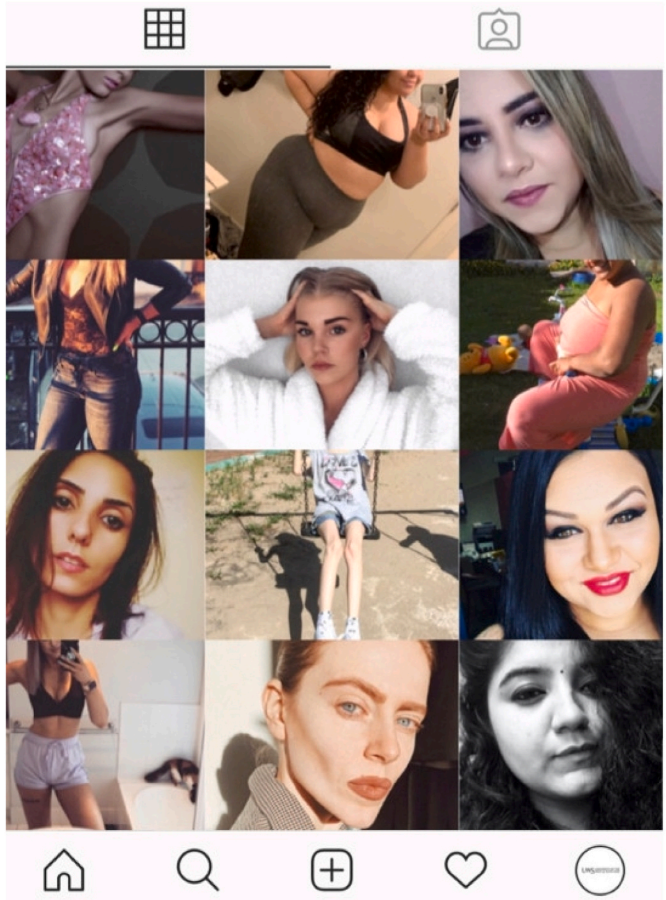
Declaration of competing interest

The authors have no competing interests to declare.

Data availability

Data will be made available on request.

Appendix A



Example Stimulus.

References

Abidin, C. (2016). Visibility labour: Engaging with Influencers' fashion brands and #OOTD advertorial campaigns on Instagram. *Media International Australia, 161*, 86–100.

Allen, K. A., Ryan, T., Gray, D. L., McInerney, D. M., & Waters, L. (2014). Social media use and social connectedness in adolescents: The positives and the potential pitfalls. *Australian Educational and Developmental Psychologist, 31*(1), 18–31. https://doi.org/10.1017/edp.2014.2

Aruguete, N., & Calvo, E. (2018). Time to #protest: Selective exposure, cascading activation, and framing in social media. *Journal of Communication, 68*(3), 480–502. https://doi.org/10.1093/joc/jqy007

Aslam, S. (2021). Instagram by the numbers: Stats, demographics & fun facts. Omnicore Accessed from https://www.omnicoreagency.com/instagram-statistics/.

Badenes-Rocha, A., Bigne, E., & Ruiz, C. (2022). Impact of cause-related marketing on consumer advocacy and cause participation: A causal model based on self-reports and eye-tracking measures. *Psychology and Marketing, 39*(1), 214–226. https://doi.org/10.1002/mar.21590

Bauer, A., Schneider, S., Waldorf, M., Braks, K., Huber, T. J., Adolph, D., & Vocks, S. (2017). Selective visual attention towards oneself and associated state body satisfaction: An eye-tracking study in adolescents with different types of eating disorders. *Journal of Abnormal Child Psychology, 45*(8), 1647–1661. https://doi.org/10.1007/s10802-017-0263-z

Bigné, E., Chatzipanagiotou, K., & Ruiz, C. (2020). Pictorial content, sequence of conflicting online reviews and consumer decision- making: The Stimulus-Organism-Response Model revisited. *Journal of Business Research, 115*, 403–416. https://doi.org/10.1016/j.jbusres.2019.11.031

Blight, M. G., Ruppel, E. K., & Schoenbauer, K. V. (2017). Sense of community on Twitter and Instagram: Exploring the roles of motives and parasocial relationships. *Cyberpsychology, Behavior, and Social Networking, 20*(5), 314–319. https://doi.org/10.1089/cyber.2016.0505

British Psychological Society. (2014). *Code of human research Ethics*. Leicester: BPS.

Brown, Z., & Tiggemann, M. (2016). Attractive celebrity and peer images on Instagram: Effect on women's mood and body image. *Body Image, 19*, 37–43. https://doi.org/10.1016/j.bodyim.2016.08.007

Bue, A. C. C. (2020). The looking glass selfie: Instagram use frequency predicts visual attention to high-anxiety body regions in young women. *Computers in Human Behavior, 108*, Article 106329. https://doi.org/10.1016/j.chb.2020.106329

Bue, A. C. C., & Harrison, K. (2020). Visual and cognitive processing of thin-ideal Instagram images containing idealized or disclaimer comments. *Body Image, 33*, 152–163. https://doi.org/10.1016/j.bodyim.2020.02.014

Bursac, Z., Gauss, C. H., Williams, D. K., & Hosmer, D. W. (2008). Purposeful selection of variables in logistic regression. *Source Code for Biology and Medicine, 3*(17). https://doi.org/10.1186/1751-0473-3-17

Casale, S., Gemelli, G., Calosi, C., Giangrasso, B., & Fioravanti, G. (2019). Multiple exposure to appearance-focused real accounts on Instagram: Effects on body image among both genders. *Current Psychology*. https://doi.org/10.1007/s12144-019-00229-6

Cash, T. F., & Deagle, E. A. (1997). The nature and extent of body-image disturbances in anorexia nervosa and bulimia nervosa: A meta-analysis. *International Journal of Eating Disorders, 22*, 107–125.

Chae, J. (2017). Virtual makeover: Selfie-taking and social media use increase selfieediting frequency through social comparison. *Computers in Human Behavior, 66*, 370–376. https://doi.org/10.1016/j.chb.2016.10.007

Clayton, R. B., Ridgway, J. L., & Hendrickse, J. (2017). Is plus size equal? The positive impact of average and plus-sized media fashion models on women's cognitive resource allocation, social comparisons, and body satisfaction. *Communication Monographs, 84*, 406–422. https://doi.org/10.1080/03637751.2017.1332770

Cliffe, C., Shetty, H., Himmerich, H., Schmidt, U., Stewart, R., & Dutta, R. (2020). Suicide attempts requiring hospitalization in patients with eating disorders: A retrospective cohort study. *International Journal of Eating Disorders, 53*(5), 728–735. https://doi.org/10.1002/eat.23240

Coetzee, V., Chen, J., Perrett, D. I., & Stephen, I. D. (2010). Deciphering faces: Quantifiable visual cues to weight. *Perception, 39*(1), 51–61. https://doi.org/10.1068/p6560

Deighton-Smith, N., & Bell, B. T. (2018). Objectifying fitness: A content and thematic analysis of #fitspiration images on social media. *Psychology of Popular Media Culture, 7*(4), 467–483. https://doi.org/10.1037/ppm0000143

Djafarova, E., & Rushworth, C. (2017). Exploring the credibility of online celebrities' Instagram profiles in influencing the purchase decisions of young female users. *Computers in Human Behavior, 68*, 1–7. https://doi.org/10.1016/j.chb.2016.11.009

Engeln, R., Loach, R., Imundo, M. N., & Zola, A. (2020). Compared to Facebook, Instagram use causes more appearance comparison and lower body satisfaction in college women. *Body Image, 34*, 38–45. https://doi.org/10.1016/j.bodyim.2020.04.007

Faraday, P. (2000). Visually critiquing web pages. In *Proceedings of the 6th conference on human factors and the web* (p. 1e13).

Fardouly, J., Diedrichs, P. C., Vartanian, L. R., & Halliwell, E. (2015). Social comparisons on social media: The impact of Facebook on young women's body image concerns and mood. *Body Image, 13*, 38–45. https://doi.org/10.1016/j. bodyim.2014.12.002

Fardouly, J., & Holland, E. (2018). Social media is not real life: The effect of attaching disclaimer-type labels to idealized social media images on women's body image and mood. *New Media & Society, 20*(11), 4311–4328. https://doi.org/10.1177/1461444818771083

Fardouly, J., Pinkus, R. T., & Vartanian, L. R. (2017). The impact of appearance comparisons made through social media, traditional media, and in person in women's everyday lives. *Body Image, 20*, 31–39. https://doi.org/10.1016/j.bodyim.2016.11.002

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7*(2), 117–140.

Fitts, P. M., Jones, R. E., & Milton, J. L. (1950). Eye movements of aircraft pilots during instrument-landing approaches. *Aeronautical Engineering Review, 9*, 24e29.

Frost, R. L., & Rickwood, D. J. (2017). A systematic review of the mental health outcomes associated with Facebook use. *Computers in Human Behavior, 76*, 576–600. https://doi.org/10.1016/j.chb.2017.08.001

Glashouwer, K. A., Jonker, N. C., Thomassen, K., & de Jong, P. J. (2016). Take a look at the bright side: Effects of positive body exposure on selective visual attention in women with high body dissatisfaction. *Behaviour Research and Therapy, 83*, 19–25. https://doi.org/10.1016/j.brat.2016.05.006

Guizzo, F., Canale, N., & Fasoli, F. (2021). Instagram Sexualization: When posts make you feel dissatisfied and wanting to change your body. *Body Image, 39*, 62–67. https://doi.org/10.1016/j.bodyim.2021.06.005

Hawker, K., & Carah, N. (2021). Snapchat's augmented reality brand culture: Sponsored filters and lenses as digital piecework. *Continuum, 35*(1), 12–29. https://doi.org/10.1080/10304312.2020.1827370

Hendrickse, J., Arpan, L. M., Clayton, R. B., & Ridgway, J. L. (2017). Instagram and college women's body image: Investigating the roles of appearance-related comparisons and intrasexual competition. *Computers in Human Behavior, 74*, 92–100. https://doi.org/10.1016/j.chb.2017.04.027

Hilbert, A., Tuschen-Caffier, B., & Vögele, C. (2002). Effects of prolonged and repeated body image exposure in bingeeating disorder. *Journal of Psychosomatic Research, 52*, 137–144. https://doi.org/10.1016/s0022-3999(01)00314-2

Jain, R. (2017). Photo editing makes people distrust social media, dating sites, report says. May 18. In *International business times*. Retrieved from https://www.ibtimes.com/photo-editing-makes-people-distrust-social-media-dating-sites-report-says 2540439.

Jansen, A., Nederkoorn, C., & Mulkens, S. (2005). Selective visual attention for ugly and beautiful body parts in eating disorders. *Behavior Research and Therapy, 43*, 183–196. https://doi.org/10.1016/j.brat.2004.01.003

Jarodzka, H., van Gog, T., Dorr, M., Scheiter, K., & Gerjets, P. (2013). Learning to see: Guiding students' attention via a model's eye movements fosters learning. *Learning and Instruction, 25*, 62e70. https://doi.org/10.1016/j.learninstruc.2012.11.004

Jennings, R. (2019). Facetune and the internet's endless pursuit of physical perfection. Vox Accessed from https://www.vox.com/the-highlight/2019/7/16/20689832/instagram-photo-editing-app-facetune.

Kleemans, M., Daalmans, S., Caarbat, I., & Anschutz, D. (2018). *Picture perfect: The direct effect of manipulated Instagram photos on body image in adolescent girls, 21* pp. 93–110). Media Psychol. https://doi.org/10.1080/15213269.2016.1257392

Limbers, C. A., Cohen, L. A., & Gray, B. A. (2018). Eating disorders in adolescent and young adult males: Prevalence, diagnosis, and treatment strategies. *Adolescent Health, Medicine and Therapeutics, 9*, 111. https://doi.org/10.2147/AHMT.S147480

Lindholm, J., Carlson, T., & Högväg, J. (2021). See me, like me! Exploring viewers' visual attention to and trait perceptions of party leaders on Instagram. *The international journal of press/politics, 26*(1), 167–187. https://doi.org/10.1177/1940161220937239

Mabe, A. G., Forney, K. J., & Keel, P. K. (2014). Do you "like" my photo? Facebook use maintains eating disorder risk. *International Journal of Eating Disorders, 47*(5), 516–523. https://doi.org/10.1002/eat.22254

Mackson, S. B., Brochu, P. M., & Schneider, B. A. (2019). Instagram: Friend or foe? The application's association with psychological well-being. *New Media & Society, 21*(10), 2160–2182. https://doi.org/10.1177/1461444819840021

Mañas-Viniegra, L., Veloso, A. I., & Cuesta, U. (2019). Fashion promotion on Instagram with eye tracking: Curvy girl influencers versus fashion brands in Spain and Portugal. *Sustainability, 11*(14), 3977. https://doi.org/10.3390/su11143977

Marengo, D., Longobardi, C., Fabris, M. A., & Settanni, M. (2018). Highly-visual social media and internalizing symptoms in adolescence: The mediating role of body image concerns. *Computers in Human Behavior, 82*, 63–69. https://doi.org/10.1016/j.chb.2018.01.003

McAndrew, F. T., & Jeong, H. S. (2012). Who does what on facebook? Age, sex, and relationship status as predictors of facebook use. *Computers in Human Behavior, 28*(6), 2359–2365. https://doi.org/10.1016/j.chb.2012.07.007

Meule, A., Richard, A., Schnepper, R., Reichenberger, J., Georgii, C., Naab, S., … Blechert, J. (2021). Emotion regulation and emotional eating in anorexia nervosa and bulimia nervosa. *Eating Disorders, 29*(2), 175–191. https://doi.org/10.1080/10640266.2019.1642036

Mohsin, M. (2021). 10 Instagram stats every marketer should know in 2021. Oberlo Accessed from https://www.oberlo.co.uk/blog/instagram-stats-every-marketer-should-know.

Montag, C., Yang, H., & Elhai, J. D. (2021). On the psychology of TikTok use: A first glimpse from empirical findings. *Frontiers in Public Health, 9*, 62. https://doi.org/10.3389/fpubh.2021.641673

Myers, T. A., & Crowther, J. H. (2009). Social comparison as a predictor of body dissatisfaction: A meta-analytic review. *Journal of Abnormal Psychology, 118*(4), 683–698. https://doi.org/10.1037/a0016763

Nagata, J. M., Thurston, I. B., Karazsia, B. T., Woolridge, D., Buckelew, S. M., Murray, S. B., & Calzo, J. P. (2021). Self-reported eating disorders and sleep disturbances in young adults: A prospective cohort study. *Eating and Weight Disorders, 26*, 695–702. https://doi.org/10.1007/s40519-020-00888-6

O'gorman, B., Sheffield, J., Clarke, R., & Griffiths, S. (2020). Guys don't talk about their bodies": A qualitative investigation of male body dissatisfaction and sociocultural influences in a sample of 40 Australian males. *Clinical Psychologist, 24*(2), 123–132. https://doi.org/10.1111/cp.12198

Pashler, H., & Harris, C. (2001). Spontaneous allocation of visual attention: Uniqueness dominates abrupt onset. *Psychonomic Bulletin & Review, 8*(4). https://doi.org/10.3758/bf03196213, 747e752.

Perkins, N. M., Ortiz, S. N., & Smith, A. S. (2020). Self-criticism longitudinally predicts nonsuicidal self-injury in eating disorders. *Eating Disorders, 28*(2), 157–170. https://doi.org/10.1080/10640266.2019.1695450

Pettersson, S. (2017). *Statistics: How filters are used by Instagram's most successful users. Medium*. Retrieved from https://medium.com/@stpe/statistics-h ow-filters-are-used-by-instagrams-most-successful-users-d44935f87fa9.

Pittman, M., & Reich, B. (2016). Social media and loneliness: Why an Instagram picture may be worth more than a thousand Twitter words. *Computers in Human Behavior, 62*, 155–167. https://doi.org/10.1016/j.chb.2016.03.084

Pravettoni, G., Leotta, S. N., & Lucchiari, C. (2008). The eye caught in the net: A study on attention and motivation in virtual environment exploration. *European Journal of Cognitive Psychology, 20*, 955e966. https://doi.org/10.1080/09541440701804564

Rajan, B. (2018). Fitness selfie and anorexia: A study of 'fitness' selfies of women on Instagram and its contribution to anorexia nervosa. *Punctum. International Journal of Semiotics, 4*(2), 66–89. https://doi.org/10.18680/hss.2018.0020

Rancourt, D., Leahey, T. M., Larose, J. G., & Crowther, J. H. (2015). Effects of weightfocused social comparisons on diet and activity outcomes in overweight and obese young women. *Obesity, 23*(1), 85–89. https://doi.org/10.1002/oby.20953

Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. *Psychological Bulletin, 124*, 372–422. https://psycnet.apa.org/doi/10.1037/0033-2909.124.3.372.

Rayner, K. (2009). Eye movements and attention in reading, scene perception and visual search. *The Quarterly Journal of Experimental Psychology, 62*, 1457e1506. https://doi.org/10.1080/17470210902816461

Rizzolatti, G., Riggio, L., Dascola, I., & Umiltá, C. (1987). Reorienting attention across the horizontal and vertical meridians: Evidence in favor of a premotor theory of attention. *Neuropsychologia, 25*(1A), 31–40. https://doi.org/10.1016/0028-3932(87)90041-8

Rodgers, R. F., Mclean, S. A., & Paxton, S. J. (2015). Longitudinal relationships among internalization of the media ideal, peer social comparison, and body dissatisfaction: Implications for the tripartite influence model. *Developmental Psychology, 51*(5), 706–713. https://doi.org/10.1037/dev0000013

Russell, J., Mulvey, B., Bennett, H., Donnelly, B., & Frig, E. (2019). Harm minimization in severe and enduring anorexia nervosa. *International Review of Psychiatry, 31*(4), 391–402. https://doi.org/10.1080/09540261.2019.1601073

Saiphoo, A. N., & Vahedi, Z. (2019). A meta-analytic review of the relationship between social media use and body image disturbance. *Computers in Human Behavior, 101*, 259–275. https://doi.org/10.1016/j.chb.2019.07.028

Schlegl, S., Meule, A., Favreau, M., & Voderholzer, U. (2020). Bulimia nervosa in times of the COVID-19 pandemic—results from an online survey of former inpatients. *European Eating Disorders Review, 28*(6), 847–854. https://doi.org/10.1002/erv.2773

Scott, G. G., & Hand, C. J. (2016). Motivation determines Facebook viewing strategy: An eye movement analysis. *Computers in Human Behavior, 56*, 267–280.

Seidman, G., & Miller, O. S. (2013). Effects of gender and physical attractiveness on visual attention to Facebook profiles. *Cyberpsychology, Behavior, and Social Networking, 16*(1), 20e24. https://doi.org/10.1089/cyber.2012.0305

Sheldon, P., & Bryant, K. (2016). Instagram: Motives for its use and relationship to narcissism and contextual age. *Computers in Human Behavior, 58*, 89–97. https://doi.org/10.1016/j.chb.2015.12.059

Slade, P. D., Dewey, M. E., Newton, T., Brodie, D., & Gundi, K. (1990). Development and preliminary validation of the body satisfaction scale (BSS). *Psychology and Health, 4*(3), 213–220. https://doi.org/10.1080/08870449008400391

Slater, A., Varsani, N., & Diedrichs, P. C. (2017). #fitspo or #loveyourself? The impact of fitspiration and self-compassion Instagram images on women's body image, self-compassion, and mood. *Body Image, 22*, 87–96. https://doi.org/10.1016/j.bodyim.2017.06.004

Smeets, E., Jansen, A., & Roefs, A. (2011). Bias for the (un)attractive self: On the role of attention in causing body (dis)satisfaction. *Health Psychology, 30*(3), 360–367. https://doi.org/10.1037/a0022095

Statistia. (2021). Distribution of Instagram users worldwide as of October 2021, by age group Accessed from https://www.statista.com/statistics/325587/instagram-global-age-group/.

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin, 128*(5), 825.

Sung, Y., Lee, J., Kim, E., & Choi, S. M. (2016). Why we post selfies: Understanding motivations for posting pictures of oneself. *Personality and Individual Differences, 97*, 260–265. https://doi.org/10.1016/j.paid.2016.03.032

Svaldi, J., Bender, J., Caffier, D., Ivanova, V., Mies, N., Fleischhaker, C., & Tuschen-Caffier, B. (2016). Negative mood increases selective attention to negatively valenced body parts in female adolescents with anorexia nervosa. *PLoS One, 11*, Article e0154462. https://doi.org/10.1371/journal.pone.0154462, 2016.

Taylor, S. E., Neter, E., & Wayment, H. A. (1995). Self-evaluation processes. *Personality and Social Psychology Bulletin, 21*(12), 1278–1287. https://doi.org/10.1177/01461672952112005

Tiggemann, M., & Polivy, J. (2010). Upward and downward: Social comparison processing of thin idealized media images. *Psychology of Women Quarterly, 34*(3), 356–364. https://doi.org/10.1111/j.1471-6402.2010.01581.x

Toma, C. L., & Hancock, J. T. (2013). Self-affirmation underlies Facebook use. *Personality and Social Psychology Bulletin, 39*(3), 321–331. https://doi.org/10.1177/0146167212474694

Turner, P. G., & Lefevre, C. E. (2017). Instagram use is linked to increased symptoms of orthorexia nervosa. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 22*(2), 277–284. https://doi.org/10.1007/s40519-017-0364-2

Tuschen-Caffier, B., Vögele, C., Bracht, S., & Hilbert, A. (2003). Psychological responses to body shape exposure in patients with bulimia nervosa. *Behaviour Research and Therapy, 41*, 573–586. https://doi.org/10.1016/s0005-7967(02)00030-x

Twenge, J. M., Martin, G. N., & Spitzberg, B. H. (2019). Trends in U.S. Adolescents' media use, 1976–2016: The rise of digital media, the decline of TV, and the (near) demise of print. *Psychology of Popular Media Culture, 8*(4), 329–345. https://doi.org/10.1037/ppm0000203

Valentine, T., Darling, S., & Donnelly, M. (2004). Why are average faces attractive? The effect of view and averageness on the attractiveness of female faces. *Psychonomic Bulletin & Review, 11*, 482–487. https://doi.org/10.3758/BF03196599

Vaterlaus, J. M., Barnett, K., Roche, C., & Young, J. A. (2016). Snapchat is more personal": An exploratory study on Snapchat behaviors and young adult interpersonal relationships. *Computers in Human Behavior, 62*, 594–601. https://doi.org/10.1016/j.chb.2016.04.029

Vraga, E., Bode, L., & Troller-Renfree, S. (2016). Beyond self-reports: Using eye tracking to measure topic and style differences in attention to social media content. *Communication Methods and Measures, 10*(2–3), 149–164. https://doi.org/10.1080/19312458.2016.1150443

de Vries, D. A., Peter, J., de Graaf, H., & Nikken, P. (2016). Adolescents' social network site use, peer appearance-related feedback, and body dissatisfaction: Testing a mediation model. *Journal of Youth and Adolescence, 45*, 211–224. https://doi.org/10.1007/s10964-015-0266-4

Webb, J. B., Vinoski, E. R., Bonar, A. S., Davies, A. E., & Etzel, L. (2017). Fat is fashionable and fit: A comparative content analysis of fatspiration and health at every size (R) Instagram images. *Body Image, 22*, 53–64. https://doi.org/10.1016/j.bodyim.2017.05.003

Williams, J. M. G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and psychopathology. *Psychological Bulletin, 120*, 3–24. https://doi.org/10.1037/0033-2909.120.1.3

Yang, S., Zhao, Y., & Ma, Y. (2019, July). Analysis of the reasons and development of short video application—taking Tik Tok as an example. Manila, Philippines. In *Proceedings of the 2019 9th international Conference on Information and social science (ICISS 2019)* (pp. 12–14). *Available from*: https://webofproceedings.org/proceedings_series/ESSP/ICISS%202019/ICISS19062.pdf.