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Zoom dysmorphia: An eye-tracking study of self-view and attention during video conferences

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Dedication

This thesis is dedicated to:

1. My childhood best friend, Kailia Ehrenborg (1996-2017). I miss you everyday. Thank you for watching over me and keeping me motivated when I wanted to give up.
2. My cousin-in-law, Brianna Stimson (1993-2024). Thank you for always radiating a bright light and for inspiring me to do what I love.

Until the future.

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Abstract

This study investigates Zoom Dysmorphia, a heightened self-awareness and self-criticism of perceived physical flaws due to prolonged self-view on video conferencing platforms, with associated behaviors resembling symptoms of Body Dysmorphic Disorder (BDD). Drawing on Veale's (2001, 2004) and Neziroglu's (2004) cognitive-behavioral models of BDD and prior studies on BDD which suggest the development and maintenance of BDD through excessive self-focused attention and attentional bias, this study explores the potential cognitive and emotional implications of this phenomenon. Participants engaged in two mock video conferences with self-view enabled in one meeting and disabled the other for comparison. Eye tracking technology monitored their gaze patterns, while pre- and post-meeting questionnaires assessed mood, self-esteem, and self-confidence. It was hypothesized that participants would focus on self-reported unattractive areas of their own face more often than other areas of their face and would focus on the same corresponding self-reported unattractive areas on others, enforcing a comparison gaze pattern as motivated by the social comparison theory applied to body dissatisfaction (Neziroglu, 2008). Moreover, it was hypothesized that, when self-view was enabled, participants would report lower self-confidence, self-esteem, and mood afterwards. Eye patterns and questionnaire responses were analyzed through paired t-tests, one way ANOVAs, and a repeated measures ANOVA. Statistical analysis found no significant difference in attention between self-reported unattractive areas of participants' faces and other areas of their faces. Participants did exhibit a shift in gaze from self-reported unattractive areas of their own face to the corresponding area on the actors that reached significance. Self-confidence, self-esteem, and mood were not significantly impacted by the presence of the self-view window.

The findings of this study provide valuable insights into the potential effects of prolonged self-view on attentional biases and social comparison processes during video conferencing. As the use of Zoom and other video conferencing platforms has become ubiquitous in work, education, and telehealth settings, understanding the psychological impact of these technologies is crucial. The results suggest that while self-view may not significantly influence mood, self-esteem, or self-confidence, it may facilitate comparisons between one's own perceived flaws and the corresponding features of others, mirroring cognitive processes seen in BDD. While further research is needed to fully understand the psychological ramifications of prolonged self-view on video conferencing platforms, these findings underscore the importance of further research into the potential consequences of extensive video conferencing use on body image concerns and mental well-being, as well as the need for strategies to mitigate any negative effects. The insights gained from this study can inform the development of guidelines and interventions to promote healthy video conferencing practices in various contexts.

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Introduction

The COVID-19 pandemic led to a significant increase in the use of videoconferencing platforms, such as Zoom, which reported 11 million daily meetings (Agbede, 2023). This shift has not only changed the way people communicate but has also had consequences on individuals' mental health, as noted in research surrounding "Zoom fatigue" (Elbogen, 2022). Concurrently, there was a 19% increase in cosmetic surgery requests from 2019 to 2022 with a 150% increase in cheek implants and a 37% increase in rhinoplasties (American Society of Plastic Surgeons, 2023). In a survey of U.S. board-certified dermatologists, 56.7% reported an increase in patients seeking cosmetic consultations compared to before the pandemic (Rice et al., 2021).

It has been hypothesized that the increase in video conferencing usage and the increase in cosmetic surgery are linked. More specifically, it is hypothesized that the prolonged exposure to oneself on video conferencing platforms has led to appearance-related concerns. In the survey of U.S. board-certified dermatologists, 56.7% reported an increase in patients seeking cosmetic consultations compared to before the pandemic, with 86.4% noting that their patients cited video conferencing as a reason for their visit and 82.7% observing that their patients were significantly more unhappy with their appearance since using video conferencing platforms during COVID (Rice et al., 2021). Furthermore, a survey of the general public by Cristel et al. (2020) found that 40.6% of participants reported plans to seek cosmetic treatment based on concerns that arose from their appearance on video calls. Thus, the increase in cheek implants and rhinoplasties mentioned previously is particularly notable as they correspond to areas typically displayed during video calls (American Society of Plastic Surgeons, 2023).

The emerging body of research surrounding Zoom fatigue and teaching over video conferencing platforms frequently report that individuals keep their camera off due to concerns

about their appearance (Castelli & Sarvary, 2021; Türk & Jafferany, 2022; Jayasundara et al., 2023; Lin et al., 2021). For example, in a spring 2020 end-of-quarter survey at Cornell, 41% of students reported concerns about their appearance as a reason for not turning on their video cameras during class (Castelli & Sarvary, 2021). The use of videoconferencing platforms has led to increased self-comparison, as individuals can simultaneously view their own image alongside others, further contributing to appearance-related distress (Türk & Jafferany, 2022; Cristel et al., 2020). Some platforms even allow users to apply filters to augment their complexion to accommodate self-consciousness concerns, such as Zoom's "Touch Up My Appearance" feature that applies a soft focus to the user's self-view window, smoothing out their skin tone creating a softer and more polished appearance (Zoom, 2024).

This increase in appearance-related concerns has led to the proposal of "Zoom Dysmorphia," a term coined by Dr. Shadi Kourosh, a board-certified dermatologist and assistant professor at Harvard Medical School who noticed this trend in her patients (Elan, 2021). Due to the novelty of the phenomenon, there is not an operational definition of Zoom Dysmorphia. Dr. Shadi Kourosh describes Zoom Dysmorphia as a self-critical comparative response of physical features that motivate individuals to pursue cosmetic treatments not considered before (Elan, 2021; Rice et al., 2020). Gasteratos et al. (2021) define zoom dysmorphia as a form of Body Dysmorphic Disorder (BDD)[1] where individuals develop an increased awareness of perceived physical flaws, leading to exaggerated self-criticism and prompting a desire for cosmetic surgery.

[1] Body Dysmorphic Disorder is a diagnosed mental disorder defined by the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM–5; American Psychiatric Association, 2013) as the "preoccupation with one or more perceived defects or flaws in physical appearance that are not observable or appear slight to others" where "the individual has performed repetitive behaviors (e.g., mirror checking, excessive grooming, skin picking, reassurance seeking) or mental acts (e.g., comparing his or her appearance with that of others) in response to the appearance concerns. "The appearance preoccupation is not better explained by concerns with body fat or weight in an individual whose symptoms meet diagnostic criteria for an eating disorder."

Ramphul (2022) and Elan (2021) give simpler descriptions of Zoom Dysmorphia that omit the pursuance of cosmetic surgery, defining it as the emergence of "unsettling changes and perceptions" of oneself and a "breakdown of how we perceive our own self-image," respectively.

Despite their slight differences in definitions, all of the authors propose that prolonged viewing of oneself on video calls results in increased self-appearance concerns and behaviors similar to those of symptoms of BDD. For the purposes of this paper, Zoom Dysmorphia will be defined as a heightened self-awareness and self-criticism of perceived physical flaws due to prolonged self-view on video conferencing platforms, with associated behaviors resembling symptoms of BDD. To better understand this phenomenon, we will review literature on BDD and its related behaviors.

Given the lack of experimental research specifically investigating Zoom Dysmorphia, it is essential to draw upon the existing literature on BDD and its related behaviors to better understand this emerging phenomenon as symptoms of BDD (e.g., mirror checking) are similar to behaviors exhibited in Zoom Dysmorphia (e.g., looking excessively at oneself in the self-view window). By examining the characteristics, cognitive processes, and behavioral patterns associated with BDD, we can draw parallels and gain valuable insights into the potential mechanisms underlying Zoom Dysmorphia and its impact on individuals' mental health and well-being.

Cognitive Behavioral Models and Self-Focused Attention in Body Dysmorphic Disorder

Veale's Cognitive Behavioral Model of Body Dysmorphic Disorder

David Veale's cognitive-behavioral model of BDD emphasizes the role of information processing, imagery, attentional biases, rumination, and safety-seeking behaviors. At the core of Veale's model is the notion of the "self as an aesthetic object," wherein individuals excessively

focus on their perceived flaws or defects, viewing themselves primarily through the lens of appearance (Veale, 2004). The cycle proposed by Veale's model begins with external triggers, such as encountering one's reflection in a mirror to receiving a comment about one's physical features, that activate a distorted mental image of one's appearance (ibid). Subsequently, a cascade of cognitive processes are stimulated (ibid).

One cognitive process is negative self-appraisal, wherein individuals with BDD over-identify with one's appearance resulting in certain features becoming central to one's identity. Idealized values, such as social acceptance or perfectionism, further reinforce this process by attaching disproportionate importance to physical appearance (Veale, 2004). These values create a framework through which individuals evaluate themselves, often leading to conditional assumptions and core beliefs about their worth based on their appearance (ibid).

Another cognitive process is their selective attention and attentional bias (i.e., the tendency to focus on certain stimuli while ignoring others [Azriel & Bar-Haim, 2020]) to perceived flaws. This selective attention prevents them from obtaining an accurate and holistic view of their appearance and the appearance of others (Veale, 2014). This results in a distorted mental self-image that is more negative than reality. This image is often from an "observer perspective," as if they are seeing themselves from the outside (ibid). Individuals with BDD compare this negative internalized self-image to both their actual reflection in the mirror and their (often unrealistic) idealized appearance (ibid). The negative self-image rarely matches either the real reflection or the individual's ideal appearance, leading to distress, rumination, and further negative appraisals of their appearance (Veale, 2004; Veale, 2014; Veale et al., 2016).

To reduce anxiety and discomfort associated with appearance-related concerns, individuals engage in safety behaviors, that is behaviors that reduce negative feelings, like

repetitive mirror gazing and comparing themselves/aspects of themselves to others (Veale & Riley, 2001; Veale et al., 2016). These behaviors paradoxically increase self-consciousness, distress, and self preoccupation in the long run as they act as a negative feedback loop (Veale, 2004; Veale, 2014; Veale et al., 2016).

As video conferences reflect the user's appearance back at them, the user sees themselves from this same "observer perspective" outlined in Veale's cognitive-behavioral model of BDD. Thus, it is plausible that video conferences prompt individuals to compare their idealized self (or their accustomed mirror reflection) with their self-view window reflection, potentially exacerbating negative self-perceptions. Moreover, as other faces are laid alongside their reflection, it is plausible that video conferences with self-view enabled encourage social comparison.

Neziroglu's Cognitive Behavioral Model of Body Dysmorphic Disorder

Fugen Neziroglu's cognitive-behavioral model of BDD emphasizes the role of classical and operant conditioning processes, and social learning. Childhood experiences, both positive and negative, play a significant role in shaping individuals' perceptions of their physical appearance. Neziroglu (2004) found that childhood experiences, particularly those reinforcing the importance of appearance, often contribute to the development of BDD. Positive reinforcement for specific physical attributes or appearance-related behaviors can solidify the belief that one's appearance is paramount (ibid). Conversely, negative experiences such as emotional or sexual abuse, bullying, or traumatic events may also contribute to the development of BDD by conditioning individuals to experience negative affect when observing their body parts later in life (Cash et al., 1986; Neziroglu et al., 2006; Osman et al., 2004; Rieves & Cash, 1996; Veale, 2004).

Grounded in Relational Frame Theory (Hayes et al., 2001; Hayes et al., 1999), Neziroglu's model also proposes that language facilitates the formation of beliefs through arbitrary and non-arbitrary connections among events (Neziroglu, 2004; Neziroglu et al., 2008). In the context of BDD, early experiences and cognitive processes shape individuals' core beliefs about attractiveness and social acceptance (ibid).

Social learning, particularly through media and interpersonal interactions, further reinforces the importance of physical appearance. By observing others being reinforced for their appearance, individuals can learn that physical attractiveness leads to rewards (Bandura, 1977). Media portrayals of attractiveness and societal emphasis on physical appearance contribute to this perception that attractiveness leads to success and acceptance (Levine & Smolak, 2002; Rieves & Cash, 1996).

Classical and evaluative conditioning play pivotal roles in the emergence of BDD symptoms. Initially, aversive events related to one's physical appearance serve as unconditioned stimuli, eliciting emotional responses like anxiety, depression, disgust, or shame. Through conditioning, these emotional responses become associated with specific words or body parts, leading to a conditioned response upon encountering the associated stimuli (Neziroglu, 2004; Neziroglu et al., 2008). Neziroglu's model thus postulates that this conditioning process contributes to the emotional distress experienced by individuals with BDD. In relation to video conferencing, the self-view window, when enabled, may serve as a conditioned stimulus, eliciting negative emotional responses and perpetuating the cycle of negative self-appraisals and attentional biases towards perceived flaws.

Research on information processing in BDD underscores how individuals with the disorder exhibit biased perceptions, processing, and recall of environmental information.

Buhlmann & Wilhelm (2004) demonstrate that individuals with BDD tend to hyper-focus on details, selectively attend to emotional stimuli, interpret ambiguous situations as threatening, and struggle with identifying others' emotional expressions, all of which contribute to the development and persistence of BDD symptoms. Like Veale, Neziroglu's model also highlights attentional bias in the development and reinforcement of BDD (Neziroglu et al., 2008).

Furthermore, the maintenance of BDD symptoms is perpetuated through operant conditioning mechanisms, specifically negative reinforcement. Cash (2002) and Cash (2008) emphasize how avoidance and safety-seeking behaviors alleviate negative emotions, thereby reinforcing their recurrence. Social comparisons (e.g., comparing specific body parts with those of others) also play significant roles in sustaining BDD symptoms (Heinberg & Thompson, 1992; Thompson et al., 1999). Again, like Veale, Neziroglu's model also emphasizes the role of safety-seeking behaviors that act as a negative feedback mechanism (Neziroglu et al., 2008).

Neziroglu's model underscores the complex relationship individuals with BDD have with their reflection, a hallmark symptom of the disorder. As part of this complex interplay, individuals with BDD commonly engage in mirror checking, a phenomenon widely documented in literature (Kollei & Martin, 2014; Veale et al., 2004; Neziroglu et al., 2006). Specifically, individuals with BDD may engage in mirror checking to see if areas of concern are still present or have gotten worse (Neziroglu, 2004). Neziroglu's model also emphasizes that, while most individuals with BDD look at their reflection in the mirror significantly more than average to the point of obsession, there exists a subgroup of individuals with BDD who actively avoid mirrors at all costs to circumvent the distress associated with perceiving a flaw in their appearance (ibid). Veale and Riley (2001) noted that while 80% of individuals with BDD engage in repetitive mirror checking, the remaining 20% avoid mirrors altogether. In both scenarios, these behaviors

serve as coping mechanisms aimed at alleviating anxiety and discomfort surrounding one's appearance, thus acting as a negative feedback loop (ibid). In video conferences, these safety-seeking behaviors might be exhibited through actions like adjusting one's appearance or position, or, as explored in this study, through frequent and repetitive glances at the self-view window.

Mood, Self-Esteem, Self-Confidence, & Gaze Patterns

Mood, self-esteem, and self-confidence may have a bidirectional relationship with gaze patterns and reflections. Seeing one's reflection not only has adverse consequences for individuals with BDD, but also those without. Windheim et al. (2011) and Veales et al. (2016) have observed that people with BDD, as well as those without the disorder, experience an increase in distress and self-focused attention (as measured through self-reporting) when exposed to a mirror for a period of time. Similarly, Barnier and Collision (2019) found that engaging in short-range mirror gazing (i.e., viewing one's reflection from a close distance) resulted in significant negative effects, including increased body shaming, heightened distress with disliked body parts, and lower self-esteem. The authors note that this effect is particularly pronounced in individuals with BDD and may contribute to the development and maintenance of the disorder. Furthermore, Chen and Zhou (2023) issued a questionnaire to video conference users that found that engaging in objective self-awareness (i.e., attention to oneself from an outsider's viewpoint often in comparison to social norms; OSA) can lead to a decrease in self-esteem. They propose that video communication platforms, such as Zoom, can trigger OSA by enabling direct observation of oneself on the screen, particularly when individuals are in a listener or audience role.

This heightened self-awareness can lead to critical self-evaluation, negative affect, and a greater acceptance of cosmetic surgery as a means to address perceived flaws (ibid). Therefore, just as excessive mirror gazing can be both a consequence and an exacerbating factor of BDD, constant exposure to one's image on video calls may fuel similar concerns about appearance. Individuals with BDD may engage in more frequent mirror gazing due to their preoccupation with perceived flaws, which in turn can heighten their symptoms. Similarly, the frequent self-view provided by video conferencing technology might intensify these preoccupations, potentially leading to what has been termed "Zoom Dysmorphia." This parallel suggests that Zoom Dysmorphia could be a modern manifestation of the distress caused by excessive mirror gazing, particularly in the context of heightened self-awareness and scrutiny facilitated by video conferencing technology especially due to the close physical proximity of the user to their reflection on the screen.

Potthoff and Schienle (2021) investigated how personality traits such as self-esteem relate to gaze behavior during mirror gazing. While being eye-tracked, participants were exposed to a mirror for 90 seconds before watching a 90 second video of a stranger. They found that individuals with higher self-esteem tended to exhibit shorter gaze durations when viewing both their own face and the faces of others, suggesting a less critical evaluation of facial features. This indicates that individuals with higher self-esteem may be less prone to engaging in excessive self-focused attention and negative self-appraisals.

Eye Tracking and Body Dysmorphic Disorder

Neziroglu and Veale's cognitive behavioral models of BDD postulate that selective attention plays a pivotal role in the maintenance of BDD. According to these models, individuals with BDD tend to overfocus on self-perceived defects in their appearance (Neziroglu,

2004; Veale, 2004). An interview survey of 50 patients with BDD found the most common area of preoccupation in BDD is the face (Veale et al., 1996).

Greenberg et al. (2014) investigated visual attention biases in individuals with BDD compared to healthy controls. Using eye-tracking technology, they presented participants with alternating photos of themselves and other faces for 40 seconds each. After viewing the photos, participants were instructed to identify the most and least attractive feature on themselves and on the other face, in addition to reporting a distress score. They found that individuals with BDD exhibited a negative bias, focusing more on their own unattractive features and less on others' attractive features, while healthy controls showed a more balanced focus. The findings suggest that this overfocus on negative attributes may play a role in the development and persistence of BDD symptoms.

Grocholewski et al. (2012) expanded on this research in their study participants were instructed to gaze at photographs of themselves and unfamiliar faces one at a time for 10.00 ms while having their eye-patterns tracked. The study found that BDD patients not only focused more on their own perceived problem areas on their faces but also directed increased attention to corresponding areas on others' faces. This aligns with additional evidence indicating an imbalance in local (detail) versus global (holistic) processing in BDD, as evidenced by a study on inverted faces (Feusner et al., 2010). Specifically, the study compared the response time to upright and inverted faces between healthy controls and individuals with BDD. They found that individuals with BDD exhibit less slowing of response time when viewing inverted faces compared to upright faces, implying a heightened reliance on part decomposition and detail processing, which are less affected by inversion compared to holistic processing (ibid).

These studies demonstrate the role of visual attention in the development of BDD. However, none of these studies utilized a side-by-side comparison of the participants' face and a stranger's face to see whether participants naturally compare features of other people's faces with their own or look to their own face as a reference point. The only study we could find that employed a side-by-side layout was by Zell and Balcetis (2012) who investigated how social comparison influences individuals' perceptions of their own attractiveness by morphing their faces with attractive and unattractive references. In this study, participants sat in front of a computer screen that had a mirror attached next to it. Participants were instructed to use the mirror to select the morphed image they perceived most similar to their own face. Findings revealed that participants who engaged in upward comparison tended to perceive themselves as less attractive, while those engaging in downward comparison perceived themselves as more attractive. Interestingly, these biased representations did not extend to strangers' faces, suggesting that the effects were specific to self-perception rather than a general cognitive bias towards beauty constructs. However, this study explicitly instructed participants to look at themselves and compare their likeness to the morphed images, thus providing explicit direction for social comparison. While the findings shed light on how individuals' perceptions of their own attractiveness are influenced by social comparison, they do not directly address whether individuals naturally engage in such comparisons during video conferences. Nor do any of the studies address whether video conferencing platforms may exacerbate the tendency to compare and attend to negative perceived facial defects.

The Evolution of Media and Its Impact on Body Image Concerns

Social comparison theory posits that people evaluate themselves and their attributes by comparing themselves to others, which can significantly impact their self-esteem and body

image (Festinger, 1954). Opportunities for social comparison (and consequently, body image concerns) have evolved alongside advancements in technology and the increasing accessibility of visual content. As photography became more affordable and widespread in the early 20th century, it began to play a significant role in shaping societal standards of beauty (Mazur, 1986). The advent of mass-produced fashion magazines and the rise of Hollywood further contributed to the dissemination of idealized images, often setting unrealistic expectations for physical appearance (Silverstein et al., 1986).

The introduction of airbrushing and other photo manipulation techniques in the latter half of the 20th century allowed for the creation and dissemination of flawless, yet unrealistic, images (Thompson & Heinberg, 1999). The pervasiveness of these manipulated images has been linked to increased body dissatisfaction and the development of eating disorders, particularly among young women (Becker, 2004; Groesz et al., 2002). A study by Tiggemann and McGill (2004) found that exposure to idealized body images in fashion magazine ads led to increased body dissatisfaction, negative mood, and appearance comparison compared to viewing product images.

The digital age and the rise of photo editing software like Photoshop have further exacerbated the issue. The creation of social media platforms have increased exposure to edited images (Fardouly & Vartanian, 2016). Moreover, they've made it easier and more accessible for individuals to alter their own images (Kee & Farid, 2011) making filters and built-in editing features that alter one's appearance a normal practice for online presentation (Kleemans et al., 2018). This has even led to a phenomenon known as "Snapchat dysmorphia," where individuals seek cosmetic surgery to resemble their filtered selfies (Rajanala et al., 2018). The constant exposure to these filtered and manipulated images has been associated with increased body

dissatisfaction, self-objectification, and a higher risk of developing eating disorders (Fardouly et al., 2018; Holland & Tiggemann, 2016).

As social media continues to evolve, with the emergence of new platforms and features like TikTok and Instagram Reels, the impact on body image concerns remains a pressing issue. The rapid pace at which content is created and consumed on these platforms, coupled with the ease of applying filters and editing effects, has further normalized the manipulation of one's appearance for online presentation (Hou, 2019).

In the context of Zoom Dysmorphia, the evolution of media is particularly relevant as video conferencing platforms introduce a new form of social comparison. The simultaneous display of one's own image alongside others during video calls creates a unique environment for self-evaluation and comparison. This real-time, side-by-side presentation of faces may intensify the impact of social comparison on self-perception and appearance-related concerns.

Moreover, the widespread adoption of video conferencing platforms during the COVID-19 pandemic has significantly increased the amount of time individuals spend observing their own image and comparing it to others. This prolonged exposure to one's own reflection, coupled with the heightened opportunities for social comparison, may contribute to the development of Zoom Dysmorphia and exacerbate pre-existing body image concerns.

As demonstrated above, the evolution of media, from early photography to the current age of social media, has had a significant impact on body image concerns. As technology continues to advance, it is crucial to understand and address the potential consequences for mental health and well-being.

Zoom Dysmorphia and the Impact of Videoconferencing

The cognitive-behavioral models proposed by Veale and Neziroglu provide a framework for understanding the cognitive processes (e.g., attentional biases, social comparison, and mirror-gazing) underlying appearance-related concerns. These concepts may also be relevant in the context of videoconferencing, where individuals are continuously exposed to their own self-view alongside the faces of others.

During video conferences, the self-view window may serve as a digital mirror, potentially triggering the same attentional biases and self-focused attention observed in BDD. Just as individuals with BDD engage in mirror-gazing and selective attention towards perceived flaws, video conference participants may be drawn to scrutinize their own appearance in the self-view window. This continuous exposure to one's own image may exacerbate appearance-related concerns and lead to a heightened awareness of perceived imperfections.

Moreover, the simultaneous display of multiple faces during video conferencing creates a unique environment for social comparison. Participants may engage in comparisons between their own facial features and those of others, similar to the comparative processes observed in BDD. This side-by-side presentation of faces may facilitate a more direct and immediate form of social comparison, potentially intensifying the impact on self-perception and body image concerns.

The bidirectional relationship between mood, self-esteem, and gaze patterns, as evidenced in studies on mirror-gazing and self-focused attention, may also extend to the videoconferencing context. Prolonged exposure to one's own image through the self-view window may lead to increased self-criticism and negative self-appraisals, resulting in lower self-confidence, self-esteem, and mood. Conversely, individuals with higher self-esteem might

be less inclined to scrutinize their own appearance or compare it unfavorably with others, resulting in reduced fixation on perceived flaws and more balanced attention to other participants' faces. As a result, they may not have a change in mood, self-esteem, or self-confidence.

While previous research has investigated eye-tracking in relation to BDD and social comparison, no study to date[2] has specifically explored these aspects in the context of Zoom Dysmorphia. Given the widespread adoption of videoconferencing platforms and the potential impact on appearance-related concerns, it is crucial to examine how the continuous presence of self-view influences participants' visual attention patterns and self-perceptions.

Objective

To understand how the continuous presence of self-view during video conferencing influences participants' visual attention patterns, particularly in areas of self-perceived concern related to facial appearance.

Hypotheses

1. Participants will focus on self-perceived "unattractive" aspects of their own face more often than other areas on their face.
2. Participants will focus on self-perceived "unattractive" aspects of their own face and the same corresponding areas on the actors' faces on the videoconferencing call video during videoconferencing, enforcing a sort of "comparison."
3. When self-view is enabled, participants will report lower self-confidence, self-esteem, and mood.

[2] To our knowledge

Methods

Participants

Forty-four undergraduate students from Dartmouth College initially participated in this study. However, data from two participants were excluded from the analysis due to technical malfunctions that corrupted the data during the study. Therefore, the final sample consisted of 42 participants, with 30 (71%) identifying as female and 12 (29%) as male. The majority of participants fell within the 20-22 age range (29 participants, 69%), followed by 17-19 (8 participants, 19%), 23-24 (3 participants, 7%), and one participant was age 25 or older (2%). The sample consisted of 5 (12%) freshmen, 5 (12%) sophomores, 7 (17%) juniors, 22 (52%) seniors, and 3 (7%) individuals in their fifth year or beyond. Racial and ethnic backgrounds varied, with the largest groups being white (17 participants, 41%) and Asian (9 participants, 21%). Other backgrounds included Latino or Hispanic (5 participants, 12%), multiracial (5 participants, 12%), Black (2 participants, 5%), Native American (1 participant, 2%), and individuals who identified as "Other" (2 participants, 5%) or preferred not to disclose (1 participant, 2%). Participants were recruited through advertisements posted around Dartmouth College's campus and were compensated $10 for their participation. The study was approved by Dartmouth College's Institutional Review Board (IRB) before commencement. All participants were presented with information about the study and a consent form prior to their participation (see Table 1).

Table 1

Participant Demographics

Sample Characteristics	Frequency	Percent (%)

Gender		
Female	30	71
Male	12	29
Age		
17-19	8	19
20-22	29	69
23-24	3	7
25+	1	2
Year in College		
Freshman	5	12
Sophomore	5	12
Junior	7	17
Senior	22	52
5th+ Year	3	7
Background		
Asian	9	21
White	17	41
Black	2	5
Latino or Hispanic	5	12
Native American	1	2
Multiracial	5	12

Other	2	5
Prefer not to say	1	2

Note: N = 42 with 2 participants' data excluded from analysis due to technical malfunctions that corrupted the data during the study.

Setup & Equipment

Equipment

Eye tracking. This study used Gazepoint GP3 Eye Tracker (Gazepoint GP3, 2024) to track participants' eye movements. The Gazepoint GP3 has a sampling rate of 60 Hz and a tracking accuracy of about 0.5 to 1 degrees of visual angle. This study used Gazepoint Analysis Professional Edition (Gazepoint, 2024) eye tracking software to collect and track the participants' eye movement during each mock video conference.

Video conferencing. This study utilized Zoom (Zoom Video Communications Inc., 2016) as the video conferencing platform on which the mock video conference meetings took place and through which the stimuli videos were recorded on.

Webcam. This study used the Logitech Brio 101 Full HD 1080p external webcam (Logitech, 2024).

Setup

The experiment was conducted in a quiet and blankly decorated room for minimal distractions. The room contained a chair and a desk with a workstation set up. The workstation consisted of a 24" computer monitor connected to a laptop and a wireless mouse. The Gazepoint GP3 eye tracker was set up below the computer monitor on a tripod so that it rested just below the bottom of the monitor. The eye tracker was angled upwards at the participant, positioned 65 cm away from the participant, and also connected to the laptop. The Logitech external webcam

was attached to the top of the monitor and connected to the laptop. The laptop was placed behind the monitor so as to be out of eyesight from the participants.

Procedure

This study employed a within-subjects design with counterbalancing. Individually, subjects participated in 1 study visit that consisted of 2 mock-meeting videoconferences. Each participant took part in two video conferences: one with the self-view enabled and one with self-view disabled (see Figure 1). The order of the recordings and the order of whether self-view was enabled or disabled were randomly and equally divided among participants. During sign up, subjects were told the purpose of the study was to investigate group decision making on video conferencing platforms. After completing the study, participants were debriefed and informed of the true intention of the study.

Figure 1

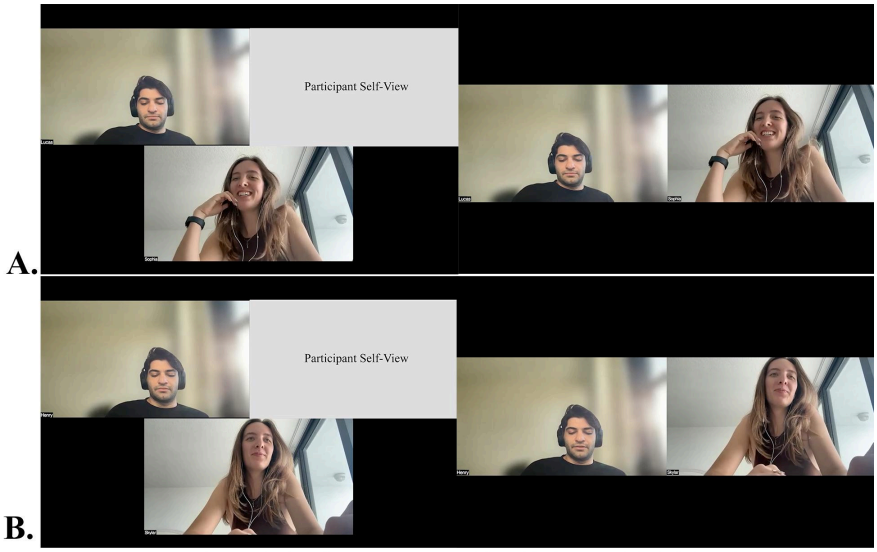


Figure 1: Comparison of stimuli counterparts with self-view enabled (left column) and self-view disabled (right column) for the first mock meeting recording (A.) and the second mock meeting recording (B).

During the study, subjects were positioned in front of the 24” monitor as the researcher reiterated the study's deceptive purpose. All participants were informed that the mock meetings

consisted of pre-recorded videos of a meeting, but were instructed to engage in the mock meeting as if it were a genuine Zoom call they were actively participating in. Additionally, while outlining the study's procedures, the researcher reminded the participants that they (the researcher) could observe them through the virtual platform. Subsequently, the eye-tracker was calibrated to each participant's gaze, after which the Gazepoint Analysis software began screen recording the 24" monitor.

For each mock video conference, the researcher left the room where they sat outside and used a separate laptop to screen-share in the Zoom meeting a pre-recorded video of a conference meeting where two 2 non-Dartmouth actors were trying to make a decision. In one meeting, the actors were trying to decide what type of fundraiser to host for their school club. This meeting lasted 4 minutes and 14 seconds. In the other meeting, the actors were trying to decide what to do for their group project. These topics were chosen to be relatable to the participants, helping to maintain their engagement and prevent them from zoning out, which could potentially alter their eye movement patterns. Additionally, the familiarity of the topics aimed to ensure that subjects felt like they were engaged in a topic within their expertise so that the conversation would not significantly impact the participants' confidence, self-esteem, or mood. This meeting lasted 4 minutes and 45 seconds. Roughly halfway through each meeting, participants were sent a comprehension question regarding the video through Zoom using the poll feature to ensure they were paying attention. The researcher re-entered the room after each mock-meeting to end the recording and administer the succeeding questionnaires.

Participants were asked to fill out Questionnaire 1 (see Appendix A) before the first mock-meeting video conference, Questionnaire 2 (see Appendix B) after the first mock-meeting video conference and before the second mock-meeting video conference, and Questionnaire 3

(see Appendix C) after the second mock-meeting video conference. Questionnaire 1 gathered background information (e.g., age, sex) and information about their mood, self-confidence, and self-esteem. Questionnaire 2 again gathered information about their mood, self-esteem, self-confidence, in addition to how likable they perceived the actors in the video presented during the videoconference. While Questionnaire 3 also gathered information about their mood, self-esteem, self-confidence, and how likable they perceived others in the meeting, it also contained questions regarding their history with BDD and symptoms related to BDD (listed on Questionnaire 3). A study by Silvia and Gendolla (2001) found that when individuals are asked to focus on specific aspects of themselves, they become more self-aware and conscious of those features. This heightened self-awareness, known as the self-awareness effect, suggests that asking individuals to evaluate or give their opinion on certain features can lead to increased attention and thought directed towards those characteristics (ibid). Therefore, questions pertaining to BDD and symptoms of BDD were administered at the end so as not to influence participants' eye patterns during the study.

Analysis

Through Gazepoint's Analysis Professional software, the self-view window (i.e., the window that displays the user's video feed/reflection enabling users to see how they appear to other participants in the meeting), when enabled, was set as an AOI (area of interest) to record the number of times participants looked at that specific area on the screen. This was done by drawing a box over the self-view window on each screen captured video taken during the mock-meeting video conference with the participant overlaid with their gaze pattern through the software's AOI setting.

Further investigation occurred on a frame-by-frame basis. This included: counting the number of times participants focused on "problem areas" on their face as they later indicated in Questionnaire 3, how many times they focused on other areas of their face not indicated as a "problem area" in Questionnaire 3, how many times they looked at "problem areas" on their own face and then shifted their gaze to the same corresponding areas on the actors' faces, and how many times they looked "problem areas" and non-problem areas on the actors' faces.

Statistical analysis of the above data was analyzed on RStudio (RStudio Team, 2022). Paired t-tests were used to test whether participants focus more on "problem areas" on their own face more often than other areas of their face (hypothesis 1). A one-sample t-test was conducted to test if participants engaged in a comparison process of their self-perceived "unattractive" areas on their face with the corresponding areas on others (hypothesis 2) by determining if this behavior significantly differed from zero, indicating a tendency to shift gaze in this manner. Finally, paired t-tests and a repeated measures ANOVA were used to examine if there are significant differences in how participants rated their self-esteem, self-confidence, and mood after engaging in a video conference with and without self-view enabled (hypothesis 3).

Results

Video Conferencing Preferences and Behaviors

Participants reported spending an average of 5.30 hours per week on video conferencing platforms (Mdn = 3.00, SD = 10.88). Checking their appearance was reported as the most common reason (52%) for looking at their self-view window while monitoring their reaction was the second most reported reason (28%; see Table 2). Additionally, the majority of participants (64%) indicated that they primarily focus their attention on the speaker during video conferences,

while a smaller percentage (14%) reported regularly looking at their self-view window (see Table 2).

Table 2

Self-Reported Video Conferencing Preferences & Behaviors

Variable	N	M	Mdn	SD
Hours spent video conferencing weekly	42	5.30	3.00	10.88
Number of times look at self-view, self-reported	42	19.93	10.00	31.90
	Frequency		Percent	
Attention during video conferences				
Speaker	27		64	
Self-View	6		14	

Other Attendees	8	19
Not at the screen/my surroundings	0	0
None of the above	1	3
Reasons to look at self-view		
Check appearance	31	52
Monitor reaction	17	28
Check background	10	17
Don’t look at self-view	0	0
Hide self-view	2	3

Facial Concerns and Body Dysmorphic Disorder Experience

Participants reported hair (29 participants, 32%) to be an area of concern the most, followed by eyes (10 participants, 11%), and skin imperfections (18 participants, 19%). A smaller proportion of participants reported concerns about lips (8 participants, 9%) and nose (6 participants, 6%). Some participants reported they believed they met criteria for BDD, with 8 participants (19%) reporting having met the criteria for BDD in the past and 7 participants (17%) reported actively meeting criteria for BDD. Additionally, 12 participants (29%) reported experiencing BDD symptoms in the past, while 17 participants (40%) reported actively experiencing them. The majority of participants (25, 59.5%) reported not having met criteria for BDD, while a small percentage preferred not to disclose their experiences (2 participants, 4.5%; see Table 3).

Table 3

Self-Reported Facial Concerns and Body Dysmorphic Disorder (BDD) Experience

Variable	Frequency	Percent (%)
Areas of facial concern		
nose	6	6
eyes	10	11
ears	0	0
Hair	29	32
Forehead	3	3
Cheeks	3	3

Skin imperfections	18	19
Wrinkles	1	1
Lips	8	9
None	3	3
Other	12	13
Experienced BDD		
Yes, in the past	8	19
Yes, active	7	17
No	25	59.5
Prefer not to say	2	4.5
Experienced BDD symptoms		
Yes, in the past	12	29
Yes, actively	17	40
No	11	26
Prefer not to say	2	5

Note: Other areas of concern reported: chin, neck, and general appearance.

Hypothesis 1

Our first hypothesis predicted that participants may focus on self-perceived "unattractive" aspects of their own face more often than other areas on their face. Paired t-tests examining participants' focus on self-perceived “unattractive” aspects of their own face versus other areas revealed non-significant differences in the number of times ($t(38) = 1.81$, $p = 0.08$), the total time

spent (t(38) = -0.29, p = 0.78), and the overall percentage of the call (t(38) = -0.88, p = 0.38) spent looking between concern areas and other facial regions (see Table 4). This suggests that there is no statistically significant difference in the frequency, duration, or proportion of participants' focus between their perceived problem areas and other facial regions. Thus, we reject the hypothesis that participants focus more on self-perceived "unattractive" aspects of their own face compared to other areas on their face during video conferencing calls.

Table 4

Paired T-Test Comparison of Focus on Concern Areas vs. Non-concern Areas on Self

Variable	Concern Areas		Non-Concern Areas		*t*(38)	*p*	Cohen's d
	M	*SD*	*M*	*SD*			
Frequency of viewings	11.33	12.59	8.87	9.07	1.81	0.08	0.22
Total time spent viewing (seconds)	3.04	3.12	3.75	4.70	-0.29	0.78	-0.18
Percent of call	0.96	0.97	1.18	1.43	-0.88	0.38	-0.19

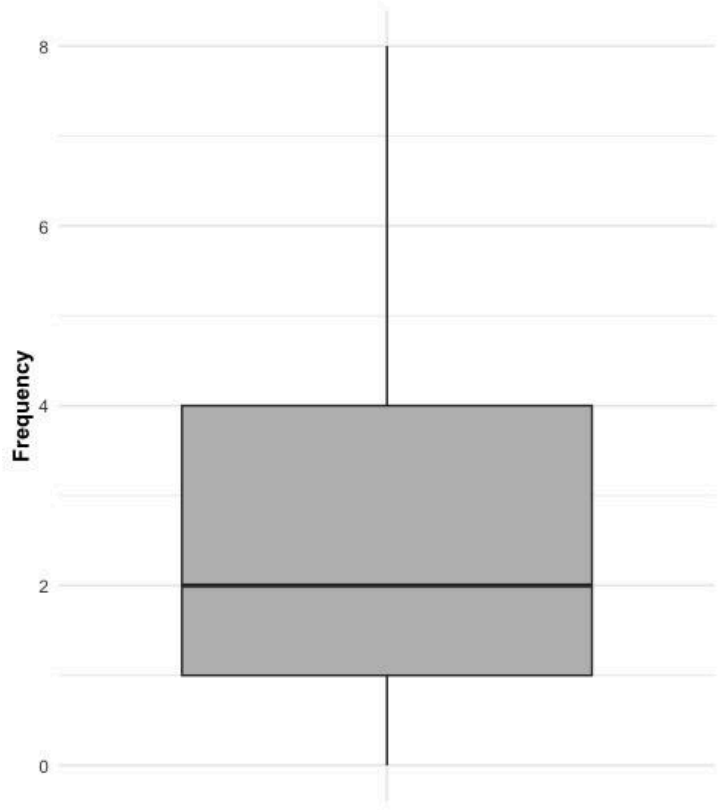
Hypothesis 2

Our second hypothesis predicted that participants would shift their gaze from their own perceived “unattractive” aspects of their face to the corresponding areas on actors' faces during video conferencing, suggesting a comparative focus.

Results of the one-sample t-test revealed a statistically significant difference from zero: $t(44) = 7.13$, $p < .001$ (see Figure 2). This finding suggests that participants exhibited a tendency to shift their gaze from their own self-reported areas of concern to corresponding areas on actors' faces during video conferencing supporting hypothesis 2.

Figure 2

Box-plot of Eye Patterns Comparing Areas of Concern During Video Conference Calls



Hypothesis 3

Our third hypothesis proposed that participants would report lower self-confidence, self-esteem, and mood when self-view was enabled. The repeated measures ANOVA found no significant main effect of self-view on self-esteem ($F(1, 44) = 0.15$, $p = .93$), self-confidence ($F(1, 44) = 0.04$, $p = .85$), or mood ($F(1, 44) = 0.42$, $p = 0.52$; see Table 5). These findings suggest that enabling the self-view did not result in significant changes in self-esteem, self-confidence, or mood across participants.

Table 5

Repeated Measures Analyses of Variance (ANOVA) of Self-Esteem, Self-Confidence, and Mood When Self-view Window Enabled

Measure	*SS*	df	MS	F	*p*	η^2
Self-Esteem						
Time	0.13	1	0.13	0.15	0.93	<0.01
Error(ID)	1.25	1	1.25			
Error: Within	107.5	160	0.67			
Self-Confidence						
Time	0.08	1	0.08	0.05	0.98	<0.01
Error(ID)	<0.01	1	<0.01			
Error: Within	115.71	160	0.72			
Mood						
Time	0.30	1	0.30	0.23	0.87	<0.01
Error(ID)	1.53	1	7.54			

Error: Within	92.33	160	0.58

The paired t-tests found that when the self-view window was enabled, there were no significant differences found in self-esteem (t(41) = 1.27, p = .21), self-confidence (t(41) = 0.37, p = .71), or mood (t(41) = -0.24, p = .81) before and after the video conference (see Table 6). Similarly, when the self-view window was disabled, there were no significant differences in self-esteem (t(41) = -0.81, p = .42) or self-confidence (t(41) = -1.14, p = .26) before and after the video conference. However, there was a noticeable trend in mood, with a near-significant difference observed: t(41) = 1.86, p = .07 (see Table 6).

Table 6

Paired T-test Examining the Effect of Self-View on Self-Esteem, Self-Confidence, and Mood.

Measure	Before		After		*t*(41)	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
Self-View Enabled							
Self-esteem	3.45	0.86	3.36	0.79	1.27	0.21	0.11
Self-confidence	3.52	0.86	3.50	0.83	0.37	0.71	0.03
Mood	3.86	0.84	3.88	0.74	-0.24	0.81	-0.03
Self-View Disabled							
Self-esteem	3.43	0.80	3.48	0.80	-0.81	0.42	-0.06

Self-confidence	3.50	0.83	3.59	0.84	-1.14	0.26	-0.08
Mood	3.93	0.76	3.76	0.79	1.86	0.07	0.22

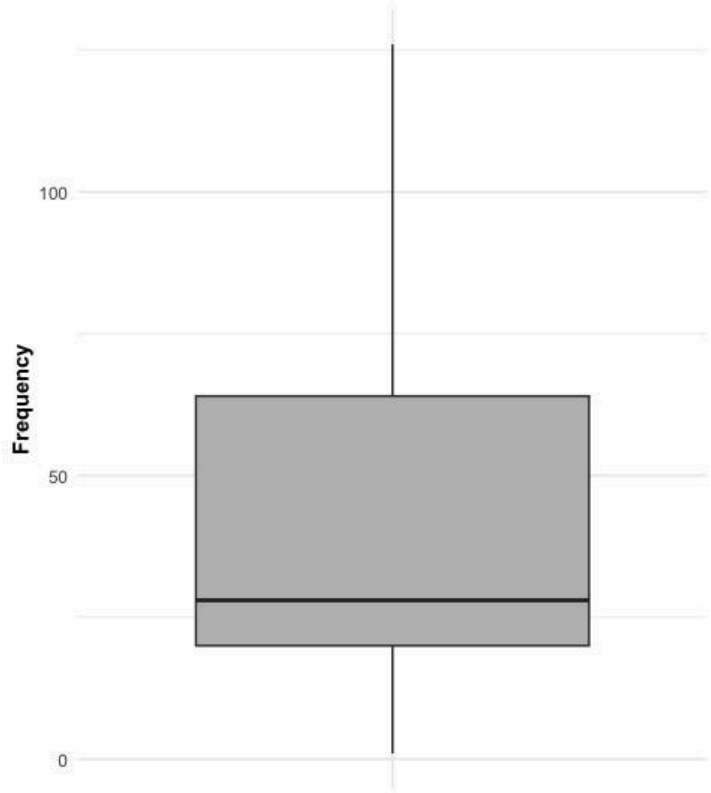
Exploratory Analysis

Engagement with Self-view Window

We conducted one-sample t-tests to examine participants' behaviors related to the self-view window during video conferencing calls when enabled. For the number of times participants looked at the self-view window, we found a significant difference from zero: $t(40) = 8.30$, $p < .001$ (see Figure 3).

Figure 3

Box Plot of Number of Times Looked at the Self-view Window



Similarly, for the total time spent looking at the self-view window, we found a significant difference from zero: $t(40) = 7.84$, $p < .001$ (see Figure 4). This was also found to be significant when considered in terms of the overall percentage of the call: $t(40) = 7.33$, $p < .001$ (see Figure 5). This suggests that participants tend to engage with their self-view window during a video call (see Table 7).

Figure 4

Box Plot of Time in Seconds Spent Looking at the Self-view Window

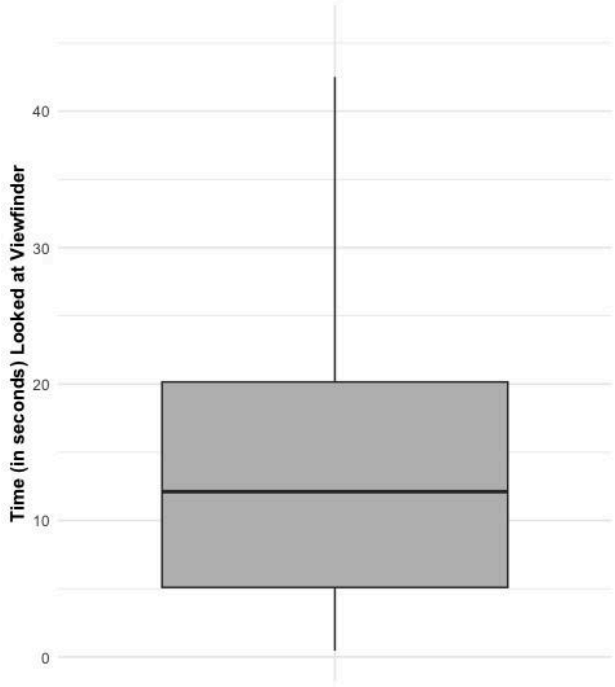


Figure 5

Box Plot of Percent of Call Spent Looking at the Self-view Window

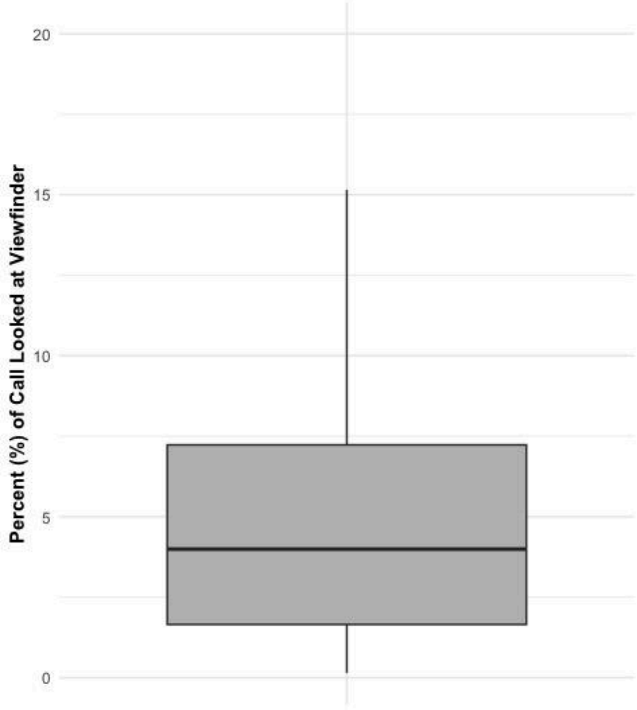


Table 7

One Sample T-Tests Examining Participant Engagement with Self-View Window When Enabled.

Measure	*M*	*SD*	*t*(40)	*p*	CI	
					Lower	Upper
Frequency of viewings	43.10	33.26	8.30	< .001	32.60	53.60
Total time spent viewing (seconds)	14.91	12.04	7.84	< .001	11.07	18.77

Percent of call	5.19	4.54	7.33	< .001	3.76	6.62

Fixation of Others' Zoom Windows With and Without Selfview Enabled

To investigate whether participants look more or less frequently at others on video conference calls when self-view is enabled versus when disabled, we conducted a paired t-test of how often participants looked at the actor's Zoom windows when self-view was enabled versus disabled. Moreover, we conducted Welch's t-tests of the duration participants looked at the actor's Zoom windows when self-view was enabled versus disabled. A Welch's t-test was chosen over a paired t-test due to the assumption of unequal variances between the groups being compared.

The frequency of viewing others differed significantly between the two conditions ($t(41) = -3.44$, $p < 0.01$; see Table 8). However, there was no significant difference in the total time spent viewing the actors' windows: $t(80.50) = -0.04$, $p = 0.97$. Additionally, the percent of call duration spent viewing the actors' windows showed an insignificant difference: $t(81.901) = -0.15$, $p = 0.88$ (see Table 9). These findings indicate that while participants tended to look at the actors' windows more frequently when self-view was enabled, the total time spent viewing and the proportion of call duration dedicated to this activity remained consistent regardless of the self-view setting. These results suggest that self-view might prompt more frequent checks of others but doesn't necessarily change how long participants spend looking at them overall. Moreover they suggest that factors other than self-view may play a more prominent role in determining participants' gaze behavior during video conference calls.

Table 8

Paired T-Test Comparison of Number of Times Subjects Revisited the Actors' Zoom Windows When Self-View is Enabled vs. Disabled

Variable	Self-View Enabled		Self-View Disabled		$t(41)$	p	Cohen's d
	M	*SD*	*M*	*SD*			
Frequency of viewings	135.93	53.8	108.7	39.25	3.44	<0.01	0.57

Table 9

Welch's t-test Comparison of Length of Time Subjects Viewed the Actors' Zoom Windows When Self-View is Enabled vs. Disabled

Variable	Welch's t	df	*p*	CI	
				Lower	Upper
Time (in seconds) Looked at Actors' Windows	-0.04	80.50	0.97	-20.94	20.09
Percent (%) of call	-0.15	81.90	0.88	-8.05	6.93

Influence of Self-View Window on Participants' Attention on Areas of Concern on Others

Welch's t-tests were conducted to investigate the influence of the self-view window on participants' attention to corresponding areas of self-concern on the actors. A Welch's t-test was chosen over a paired t-test due to the assumption of unequal variances between the groups being compared.

Analyses found no significant difference in frequency of viewings ($t(80.73) = 0.33$, $p = 0.74$), total time spent viewing concern areas ($t(79.14) = 0.66$, $p = 0.51$), or percentage of the call spent viewing concern areas ($t(81.57) = 0.06$, $p = 0.95$) on actors when the self-view window was enabled or disabled (see Table 10). Therefore, based on these findings, we fail to reject the

null hypothesis in all three cases, suggesting that there is no statistically significant difference in means between the compared variables. This suggests that the presence or absence of the self-view window did not have a significant impact on participants' attention to self-concern areas on others during video conferencing calls.

Table 10

Welch's T-Test Comparison of Focus on Concern Areas on Actors with Self-view Enabled and Disabled

Measure	Welch's t	df	*p*	CI	
				Lower	Upper
Frequency of viewings	0.33	80.73	0.74	-41.61	58.33
Total time spent viewing (seconds)	0.66	79.14	0.51	-15.88	31.58
Percent of call	0.06	81.57	0.95	-7.49	7.95

Impact of BDD Experience on Attention During Video Conferences

BDD & Attention to Concern Areas on Oneself. One-way ANOVA tests revealed no significant influence of self-reported BDD on the number of times participants' looked at areas of concern in their self-view window ($F(3, 36) = 1.15$, $p = 0.34$), time spent viewing areas of

concern on oneself ($F(3, 36) = 0.99$, $p = 0.40$), or the percentage of call time devoted to these areas ($F(3, 36) = 0.71$, $p = 0.55$; see Table 11).

Table 11

One-Way ANOVA Examining the Influence of Self-Reported BDD on Attention to Areas of Concern on Self During Video Conference Calls

Measure	Df	Sum Sq.	Mean Sq.	F	*p*
Frequency of Viewing					
BDD	3	331	110.2	0.71	0.55
Residuals	35	5453	155.8		
Total time spent viewing (seconds)					
BDD	3	29.9	9.97	0.99	0.40
Residuals	36	359.1	9.96		
Percent of call					
BDD	3	3.39	1.13	1.15	0.34
Residuals	36	35.29	0.98		

BDD Symptoms & Attention to Concern Areas on Oneself. One-way ANOVA tests revealed no significant influence of self-reported BDD symptoms on the number of times participants' looked at areas of concern in their self-view window ($F(3, 35) = 0.97$, $p = 0.42$),

time spent viewing areas of concern on oneself ($F(3, 36) = 0.26$, $p = 0.85$), or the percentage of call time devoted to these areas ($F(3, 36) = 0.56$, $p = 0.64$; see Table 12).

Table 12

One-Way ANOVA Examining the Influence of Self-Reported BDD Symptoms on Attention to Areas of Concern on Self During Video Conference Calls

Measure	Df	Sum Sq.	Mean Sq.	F	*p*
Frequency of Viewing					
BDD symptoms	3	446	148.5	0.97	0.42
Residuals	35	5338	152.8		
Total time spent viewing (seconds)					
BDD symptoms	3	8.4	2.80	0.26	0.85
Residuals	36	380.6	10.57		
Percent of call					
BDD symptoms	3	1.74	0.58	0.56	0.64
Residuals	36	36.94	1.02		

BDD & Attention to Concern Areas on Others. One-way ANOVA tests revealed no significant influence of self-reported BDD on the number of times participants' looked at areas of self-concern on the actors during the video conferences ($F(3, 38) = 1.54$, $p = 0.22$), time spent viewing concern areas on actors ($F(3, 38) = 0.59$, $p = 0.62$), or the percentage of call time devoted to these areas ($F(3, 38) = 0.70$, $p = 0.56$; see Table 13).

Table 13

One-Way ANOVA Examining the Influence of Self-Reported BDD on Attention to Areas of Concern on Others During Video Conference Calls

Measure	Df	Sum Sq.	Mean Sq.	F	*p*
Frequency of Viewing					
BDD	3	66270	22090	1.54	0.22
Residuals	38	545019	14343		
Total time spent viewing (seconds)					
BDD	3	6522	2174	0.59	0.62
Residuals	38	139162	3662		
Percent of call					
BDD	3	732	243.9	0.70	0.56
Residuals	38	13170	346.6		

BDD Symptoms & Attention to Concern Areas on Actors. One-way ANOVA tests revealed no significant influence of self-reported BDD symptoms on the number of times participants' looked at areas of concern on the actors ($F(3, 38) = 1.44$, $p = 0.25$), time spent viewing concern areas on actors ($F(3, 38) = 0.65$, $p = 0.59$), or the percentage of call time devoted to these areas ($F(3, 38) = 0.20$, $p = 0.90$; see Table 14).

Table 14

One-Way ANOVA Examining the Influence of Self-Reported BDD Symptoms on Attention to Areas of Concern on Others During Video Conference Calls

Measure	Df	Sum Sq.	Mean Sq.	F	*p*
Frequency of Viewing					
BDD symptoms	3	62457	20819	1.44	0.25
Residuals	38	548831	14443		
Total time spent viewing (seconds)					
BDD symptoms	3	7074	2358	0.65	0.59
Residuals	38	138609	3648		
Percent of call					

BDD symptoms	3	213	71.1	0.20	0.90
Residuals	38	13688	360.2		

BDD & BDD Symptoms Influence on Eye Patterns Comparing Areas of Concern.

One-way ANOVA tests found self-reported BDD experience did not significantly influence participants to engage in a comparison process of their self-perceived areas of concern on their face with the corresponding areas on others ($F(3, 37) = 1.17$, $p = 0.33$) nor did the presence of self-reported BDD symptoms ($F(3, 37) = 0.51$, $p = 0.68$; see Table 15).

Table 15

One-Way ANOVA Examining the Influence of Self-Reported BDD & BDD Symptoms on Eye Patterns Comparing Areas of Concern During Video Conference Calls

Measure	Df	Sum Sq.	Mean Sq.	F	*p*
BDD symptoms	3	6.28	2.095	0.51	0.68
Residuals	37	152.74	4.13		
BDD	3	13.81	4.60	1.17	0.33
Residuals	37	145.21	3.93		

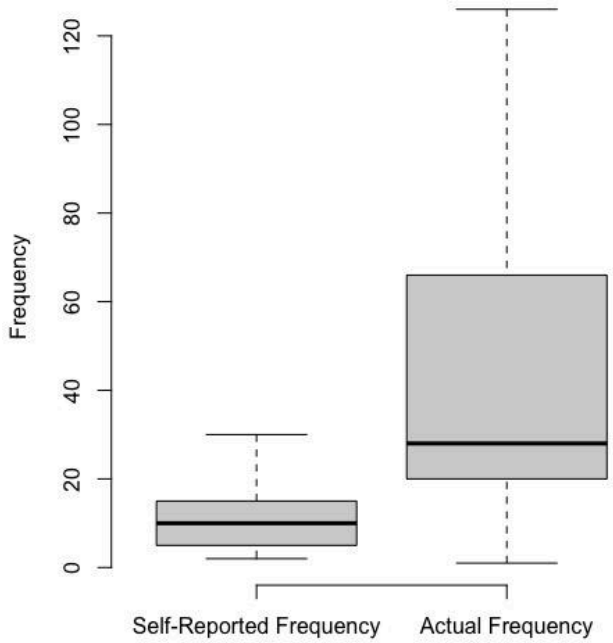
Overall, the one-way ANOVA tests suggest that neither BDD nor its associated symptoms significantly influence individuals' attention to self-concern areas on themselves, on others, or comparing areas of self-concern with others during video conferencing calls.

Differences in Self-Reported Frequency and Actual Frequency of Looking at Self-View Window

Entire Self-View Window. A paired t-test revealed a significant difference between the self-reported frequency and the actual frequency of viewing of the self-view window ($t(36) = -5.59$, $p < 0.001$; see Figure 6). These findings suggest that there is a substantial disparity between individuals' self-reported frequency of using the self-view window and their actual frequency of doing so.

Figure 6

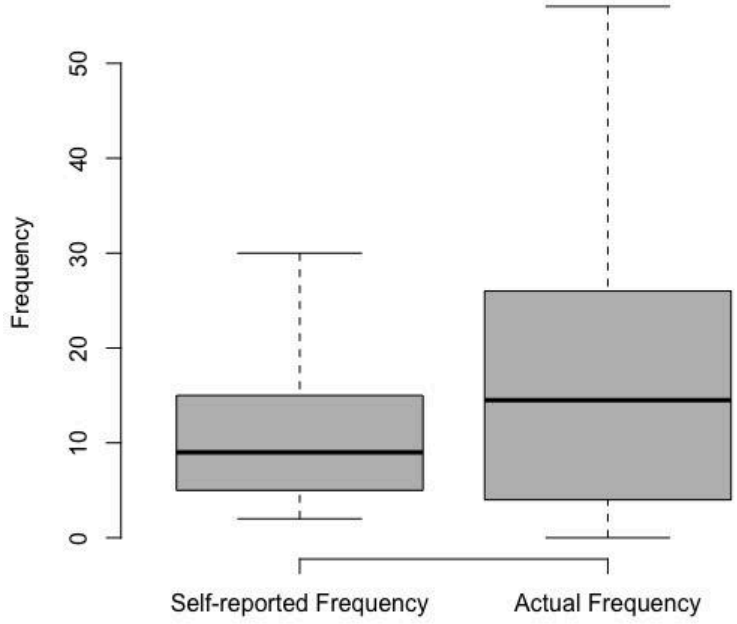
Box-plot of Self-Reported Frequency and Actual Frequency of Viewing the Self-View Window During Video Conferences



Areas of Self-Concern and Non-Concern on Own Face. A two-sample t-test found a significant difference between self-reported frequency of the self-view window and the actual frequency participants viewed areas of concern combined with areas of non-concern on their face ($t(33) = -2.28$, $p = 0.03$; see Figure 7).

Figure 7

Box-plot of Self-Reported Frequency the Self-View Window and Actual Frequency of Viewing Areas of Concern and Non-Concern on Own Face Combined During Video Conferences



Discussion

The present study investigated the influence of self-view during video conferencing on participants' visual attention patterns, particularly focusing on areas related to self-perceived

facial concerns. We aimed to shed light on the hypothesized-phenomenon termed "Zoom Dysmorphia" and its potential impact on attentional biases during video conferencing sessions.

Hypothesis Testing:

Hypothesis 1

Our first hypothesis suggested that participants would focus more on self-perceived "unattractive" aspects of their own faces compared to other areas of their face. However, our results did not support this hypothesis. There were no statistically significant differences in the frequency, duration, or proportion of participants' focus between their perceived problem areas and other facial regions. This suggests that participants' attention during video calls is not disproportionately directed towards their perceived flaws.

It should be noted that at the end of the experiment, several participants informed the researcher that they had purposely restrained themselves from looking at themselves in the self-view window. This intentional avoidance of the self-view window could explain why there were no statistically significant differences observed in participants' attention toward their perceived problem areas compared to other facial regions. If participants consciously avoided looking at the self-view window, it would reduce the opportunity for them to focus on their perceived flaws, thus contributing to the lack of support for hypothesis 1.

Hypothesis 2

Our second hypothesis proposed that participants would shift their gaze from their own perceived “unattractive” aspects of their face to the corresponding areas on actors' faces during video conferencing, suggesting a comparative gaze pattern. Our results supported the notion of a comparative gaze pattern, indicating that participants redirected their attention from their own self-reported areas of concern to corresponding regions on actors' faces as outlined in

Neziroglu's (2004) cognitive behavioral model of BDD. This finding underscores the role of social comparison in shaping visual attention dynamics during video conferencing interactions.

Hypothesis 3

Our third hypothesis anticipated that enabling self-view would result in lower self-confidence, self-esteem, and mood. However, our results did not find significant differences in these variables with the presence or absence of self-view during video conferencing. This contrasts studies that accessed these variables relative to mirror gazing (Windheim et al., 2011; Veales et al., 2016; Barnier & Collision, 2019). Moreover, it contrasts the negatively correlated influence of self-esteem on attention to oneself as reported by Potthoff and Schienle (2021).

As mentioned previously, several participants informed the researcher that they had purposely restrained themselves from looking at themselves. It is possible that individuals may actively regulate their gaze behavior during video conferencing interactions, potentially as a coping mechanism to mitigate self-consciousness or discomfort associated with self-view. By consciously averting their gaze from the self-view window, participants may seek to alleviate the pressure of self-observation and maintain a more naturalistic engagement with the virtual environment. This would explain the lack of significant statistical results for hypothesis 3.

Exploratory Analysis

Our exploratory analysis revealed that participants tended to engage frequently with the self-view window when enabled, spending a substantial portion of their video call time looking at it. However, the presence or absence of the self-view window did not significantly impact participants' attention to self-concern areas on others during video conferencing calls. Furthermore, we found no significant influence of self-reported BDD experience or self-reported BDD symptoms on participants' attention to areas of concern on themselves or on others during

video conference calls. This finding suggests that individuals with self-reported BDD or related symptoms may not necessarily exhibit different attentional patterns during video conferences compared to those without such concerns. However, given the relatively small sample size, the self-reported nature of BDD and symptom experiences, and subjects' confessions of trying to avoid looking at the self-view window, further research is needed to confirm these results.

There was a significant disparity between individuals' self-reported frequency of looking at the self-view window and their actual frequency of doing so. This suggests that individuals may not accurately perceive their own behaviors during video conferencing calls, and it is possible that looking at the self-view occurs unconsciously.

Overall, the study provides insights into participants' behaviors and attitudes during video conferencing calls, particularly regarding attention to self-appearance and its association with BDD symptom behaviors and psychological factors. The findings suggest that while individuals may engage with their self-view more frequently than expected, this does not necessarily lead to heightened focus on self-perceived flaws or negative impacts on self-esteem, self-confidence, or mood. However, the observed tendency to compare areas of self-concern with others highlights the potential for video conferences to facilitate social comparison processes, which may have implications for body image and self-perception.

The findings contribute to our understanding of how individuals interact with technology-mediated communication platforms and their perceptions of self-appearance in such contexts. These findings have implications for both mental health professionals and developers of video conferencing platforms, highlighting the importance of considering the potential psychological impacts of continuous self-view during online interactions.

Limitations and Future Research

There were several limitations of the study. Firstly, the Gazepoint GP3 Eye-Tracker did not work with individuals who wore contacts and, as with one participant whose data was thrown out, occasionally had difficulty with subjects who wore glasses.

Secondly, there was an inconsistent accuracy of the eye tracker in reliably capturing gaze positions. Despite calibrating it for each participant (sometimes multiple times), the eye-tracker did not always reliably locate the correct position. This was especially notable in the corners, which is significant as the self-view window on video conferencing platforms are generally located in the corners (such as in this study where it was placed in the upper right quarter). This limitation could have affected the reliability and validity of the data collected, potentially leading to inaccuracies in analyzing participants' gaze patterns during the video conference simulation, especially on their own face. In a series of 15 trials, where one of the researchers calibrated the eye tracker before looking at each of the 9 calibration points afterwards, the eye tracker was 66.66% accurate in the 4 corner points with a 86.67% accuracy rate in the middle point. Most of the inaccurate points deviated by ~1.5 cm. As the subjects sat roughly 60 cm away from the eye tracker (and thus computer monitor), this deviation of 1.5 cm could be the difference between an area of concern and an area of non concern thus resulting in misleading or inaccurate results.

Thirdly, while the video looked like a video conference, it differed in several ways. The most notable was the absence of live participants in the simulated video conference setting. This may have prevented participants, who were aware that they were watching a pre-recorded video, from experiencing the emotional aspect associated with real-time interactions, such as the awareness of being seen or the anticipation of responses. While participants were informed that the researcher was on the other side of the Zoom call and could see their face, and that the

participant would be answering a question at some point in the call, the participants did not have a live feed of the researcher nor did they have to answer anything verbally, thus the emotional toil of being watched and verbally responding may not have been significant. This limitation may have influenced participants' behavior and responses during the study, potentially leading them to look less at their self-view monitor because they felt less need to check their appearance. Conversely, it may have given them more time to focus on their self-view window and to analyze the actors' facial features thus affecting their gaze patterns. Another notable difference is the lack of participation in the mock-meeting decision making process. While the participants were told to pretend like it was a normal group discussion over Zoom, their lack of participation may have reduced stress and anxiety levels compared to real-life scenarios where they would normally add input. This too may have decreased the participants' need to check their appearance or monitor their reaction (the two most reported reasons for looking at the self-view window) in the self-view window. Additionally, the mock-meeting recordings used in the study were scripted, meaning that participants were exposed to predetermined scenarios and interactions. This may have introduced artificiality and reduced the authenticity of participants' responses, potentially limiting the study's ability to capture naturalistic behaviors and reactions in video conferencing contexts.

Fourthly, this study used a high quality webcam that was filmed in 1080p. This higher resolution of the webcam may have presented participants in a more flattering light, potentially enhancing their self-image, self-confidence, and mood during the study. In contrast, a lower quality camera, such as 720p, may distort facial features or produce inaccurate coloring affecting how participants perceive their appearance. This may lead participants to feel the need to scrutinize their image more closely to compensate for the lack of clarity, leading to increased

self-focused attention. Moreover, a lower quality camera may influence a participant's self-confidence, self-esteem, and mood due to the increased self-focused attention. Alternatively, the higher resolution of the camera may have led to heightened self-awareness and self-consciousness as it provided a clearer and more detailed view of their facial features and expressions compared to lower-quality webcams by highlighting imperfections or flaws unable to be seen on lower-quality webcams. Additionally, the increased sharpness and clarity of the webcam footage may prompt participants to compare their facial features with other participants influencing their feelings of self-esteem and body image.

Fifthly, the length of the mock meeting calls may have influenced participants' engagement and attention throughout the study. The duration of the mock meetings, approximately 4 minutes and 15 seconds each, could have impacted participants' sustained focus on the video content and their self-monitoring behaviors. Longer durations may have provided more opportunities for participants to scrutinize their own appearance and compare themselves to the actors in the video, potentially exacerbating feelings of self-consciousness or body dissatisfaction. Conversely, shorter durations may have limited the extent to which participants could engage with the content, look at the self-view window, and fully immerse themselves in the simulated meeting environment.

Sixthly, this study utilized undergraduate students from Dartmouth College. As the participants ranged from 17-25, this limits the generalizability of the study to a broader population. Additionally, the participants' shared educational background at the same institution, especially among those who attended during the Covid-19 pandemic, may have introduced similarities in their video conferencing etiquette. Thus, this study may not capture the diversity

of behaviors and perspectives present in a broader population limiting the external validity of the study's findings.

Seventhly, the study did not investigate how often participants shifted their attention from areas of non-concern on their own face to the corresponding areas on actors. Thus, it's possible that the results found in hypothesis 2 are merely a baseline effect meaning people might naturally shift their gaze in this manner regardless of whether it is an area of concern or not.

Eightly, this study relied on self-reporting. It is possible that some participants did not accurately give or purposely gave incorrect information. For example, what the participant deems as meeting criteria for BDD experience (both currently and in the past) may not align with medical standards. This discrepancy may explain why self-reported BDD and associated symptoms did not predict, mediate, or correlate with gaze patterns.

Finally, the proximity of the control mock meeting, where the self-view window was disabled, to the experimental meeting might have inadvertently revealed the true nature of the study to participants who had their self-view window disabled during the first mock meeting. This awareness could have potentially influenced their behavior, leading them to look less at the self-view window during the second mock meeting.

Future studies

Future research should address the limitations identified in this study to further enhance our understanding of video conferencing dynamics and their impact on self-perception and behavior. Firstly, alternative eye-tracking methods compatible with contact lens wearers should be explored to ensure inclusivity and accuracy in capturing participants' gaze patterns during video conferences. Additionally, advancements in eye-tracking technology should be pursued to

improve the reliability and precision of gaze position detection, particularly in capturing gaze positions in the corners of the screen.

Secondly, future studies should aim to recreate video conferencing environments that closely mimic real-life interactions by incorporating live participants and unscripted discussions. This would allow for more authentic emotional experiences, such as the awareness of being seen and the anticipation of responses. Participants should be actively engaged in the meeting discussions, verbally responding to prompts and contributing to the decision-making process. This would more closely resemble real-life video conferencing scenarios and capture the emotional toll of being watched and verbally responding.

Thirdly, future studies should investigate the impact of different webcam resolutions on participants' self-perceptions and gaze patterns. This may shed light on how webcam resolution influences individuals' self-image/self-esteem and behavior during video conferencing, if at all. Furthermore, studying how webcam resolution influences gaze patterns could reveal whether individuals' attention is disproportionately drawn to their own image at higher resolutions. If so, this could contribute to feelings of self-consciousness and distraction, exacerbating Zoom dysmorphia. Conversely, a difference in webcam resolution with the participant having a higher resolution camera than other participants, may increase self-confidence and self-esteem.

Fourthly, the duration of the mock meeting calls should be varied in future studies to assess the impact of time on participants' engagement and attention. Longer durations may allow for more opportunities to scrutinize one's appearance and make comparisons, while shorter durations may limit the extent of self-focused attention.

Fifthly, future studies should investigate whether negatively toned verses positively toned Zoom conversations that center around body dysmorphic-specific words affect gaze patterns on

areas of concern. This would build upon the study by Toh et al. (2017) which found that individuals with BDD exhibit attentional biases towards negative disorder-specific words, suggesting heightened sensitivity to negative stimuli related to perceived flaws in physical appearance. This may also influence individuals with BDD to look at these areas in the self-view window.

Sixthly, future studies should investigate power structures' and authority influence on self-view gazing. For example, future studies may investigate whether participants are more likely to have a change in mood, self-confidence, self-esteem, and gaze patterns when video conferencing with a professor versus family versus a friend. It is possible that video conferencing with those who participants deem as more authoritative will increase anxiety and self-consciousness thus reducing mood, self-confidence, and self-esteem over the course of the video conference and potentially motivating self-gazing and comparison.

Finally, future research should access aspects of hypothesis 2 further. That is, future research should: 1) duplicate the results, 2) investigate whether commonalities in appearance of the actor and the participant correlate to higher gaze comparison of self-reported concern areas, and 3) investigate whether subjects engage in this comparison gaze pattern more often with those they deem more or less attractive than themselves.

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Questionnaire 1

1. What year are you?
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior
    e. 5th year+
    f. Graduate student

2. How old are you?
    a. 17-19
    b. 20-22
    c. 23-24
    d. 25 or older

3. What gender do you identify with?
    a. Female
    b. Male
    c. Non-binary
    d. Prefer not to say

4. What is your racial or ethnic background?
    a. White
    b. Black or African American
    c. Asian
    d. Hispanic or Latino
    e. Native American
    f. Multiracial
    g. Other (please specify) _____
    h. Prefer not to say

5. How many hours a week do you engage in video conferencing (e.g., FaceTime, Zoom, etc.) for work or personal purposes? _____

6. Rate your current self-esteem.

1. Low Self-esteem	2. Somewhat low Self-esteem	3. Moderate self-esteem	4. Somewhat high self-esteem	5. High self-esteem

7. Rate your current mood.

1.	2.	3.	4.	5.
Negative	Somewhat negative	Neutral	Somewhat positive	Positive

8. Rate your current self-confidence.

1.	2.	3.	4.	5.
Low	Somewhat Low	Moderate	Somewhat High	High

Questionnaire 2

1. Based on your observations and impressions, rate the likeability of the female actress featured in the previous video.

1.	2.	3.	4.	5.
Extremely unlikeable	slightly unlikeable	Neither likeable or unlikeable	slightly likeable	extremely likeable

2. Based on your observations and impressions, rate the likeability of the male actor featured in the previous video.

1.	2.	3.	4.	5.
Extremely unlikeable	slightly unlikeable	Neither likeable or unlikeable	slightly likeable	extremely likeable

3. Which actor do you believe took a leading role in steering the decision-making process?
    a. The female actress
    b. The male actor
    c. Both actors equally led the decision
    d. No clear leader

4. Rate your current self-esteem.

1.	2.	3.	4.	5.
Low Self-esteem	Somewhat low Self-esteem	Moderate self-esteem	Somewhat high self-esteem	High self-esteem

5. Rate your current mood.

1.	2.	3.	4.	5.
Negative	Somewhat negative	Neutral	Somewhat positive	Positive

6. Rate your current self-confidence.

1.	2.	3.	4.	5.
Low	Somewhat Low	Moderate	Somewhat High	High

Questionnaire 3

1. Based on your observations and impressions, rate the likeability of the female actress featured in the previous video.

1.	2.	3.	4.	5.
Extremely unlikeable	slightly unlikeable	Neither likeable or unlikeable	slightly likeable	extremely likeable

2. Based on your observations and impressions, rate the likeability of the male actor featured in the previous video.

1.	2.	3.	4.	5.
Extremely unlikeable	slightly unlikeable	Neither likeable or unlikeable	slightly likeable	extremely likeable

3. Which actor do you believe took a leading role in steering the decision-making process?
    a. The female actress
    b. The male actor
    c. Both actors equally led the decision
    d. No clear leader

4. Which statement best describes your video conferencing behavior?
    a. I use a virtual background.
    b. I don't turn on my camera because of my appearance.
    c. I don't turn on my camera because of my surrounding environment.
    d. I don't turn on my camera because of other reasons.
    e. I neither use a virtual background or turn off my camera.

5. Rate your current self-esteem.

1.	2.	3.	4.	5.
Low Self-esteem	Somewhat low Self-esteem	Moderate self-esteem	Somewhat high self-esteem	High self-esteem

6. Rate your current mood.

1.	2.	3.	4.	5.
Negative	Somewhat negative	Neutral	Somewhat positive	Positive

7. Rate your current self-confidence.

1.	2.	3.	4.	5.
Low	Somewhat Low	Moderate	Somewhat High	High

8. On average, how many times do you look at your self-view window during a video conference? _____

9. If you look at your self-view window, is it to:
    a. Check my appearance
    b. Monitor my reaction
    c. Check my background
    d. I don't look at my self-view window
    e. I hide my self-view window

10. During video calls, people may have areas of their face they may feel self-conscious about or pay more attention to. Are there any specific parts of your face that you tend to focus on or consider as areas of concern when you are on a video call? Circle all that apply.

a. Nose
b. Eyes
c. Ears
d. Hair
e. Forehead
f. Cheeks
g. Skin imperfections (e.g., acne, beauty marks, etc.)
h. Wrinkles
i. Lips
j. None
k. Other – please describe: _____

11. What do you primarily pay attention to during video conferences?
    a. The person speaking
    b. Other attendees
    c. My self-view window
    d. Not at the screen/my surroundings
    e. None of the above

12. Have you ever experienced body dysmorphic disorder?
    a. Yes, but no longer active
    b. Yes, and it's active
    c. No
    d. Prefer not to answer

13. Have you ever experienced symptoms of body dysmorphic disorder (e.g., frequently checking your body in reflective surfaces, avoiding mirrors, attempting to hide a body part under clothes or makeup, constantly grooming yourself, a preoccupation with your body size, constantly comparing yourself to others, constantly asking others if you look OK, not believing others when they say you look fine, avoiding social activities because of your appearance, overestimating your body measurements, etc.)?
    a. Yes, in the past
    b. Yes, actively
    c. No
    d. Prefer not to answer