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# Through the eyes of envy: how social anxiety fuel risky appearance management behaviors

Chen Yang<sup>1\*</sup>, Xue Yang<sup>2†</sup> and Yan-Qian Liu<sup>1</sup>

## Abstract

**Background** This study examined the role of envy in socially anxious situations and its impact on risky appearance management behaviors (AMBs). The primary goal was to determine whether envy mediates the relationship between state social anxiety and non-routine AMBs.

**Methods** Three experiments were conducted. Study 1 (Study 1a:  $n = 140$ ; Study 1b:  $n = 162$ ) induced social anxiety using two different paradigms, revealing that individuals in a socially anxious state reported increased envy, leading to a higher willingness to engage in risky skin management, diet pill use, and cosmetic surgery compared to the control condition. Study 2 ( $n = 99$ ) directly manipulated envy and found that participants primed with envy were more prone to participating in non-routine AMBs than those in a neutral condition.

**Results** Overall, the findings showed that social anxiety triggered heightened envy, which mediated the association between state social anxiety and non-routine AMBs. Furthermore, envy also exerted a direct influence on these behaviors.

**Conclusions** The study enhances our comprehension of the interplay between social anxiety and envy, providing a foundation for future exploration into how these emotions intertwine and shape both mental health and risk behaviors. Concretely, our findings uncover various avenues for exploring how social anxiety interacts with distinct emotions, impacting individuals' psychological and behavioral well-being.

**Keywords** Social anxiety, Envy, Appearance management behaviors, Non-routine behaviors, Self-presentation, Cosmetic surgery

## Background

The Queen's envy of Snow White illustrates the intense emotional power of envy, often intertwined with anxiety, especially when comparisons exacerbate feelings of inferiority. This dynamic is evident in the Queen's extreme actions, driven by her anxiety and envy as she seeks to

reclaim her self-worth, highlighting the dangers of such emotional entanglements.

Throughout evolutionary history, beauty has signified reproductive and social advantages for women, prompting its relentless pursuit across cultures. Societal norms that equate physical attractiveness with success foster widespread anxiety, particularly in women who internalize idealized beauty standards. The internalization of these ideals, coupled with fears of negative evaluation and a focus on appearance, significantly increases the risk of disordered eating and other health-risk behaviors [1, 2].

This study explores situationally induced social anxiety, particularly stemming from interpersonal issues and framed by self-presentation theory. It focuses on

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the social anxiety that women feel under scrutiny, often intertwined with envy. This emotional interplay drives women's engagement in risky beauty practices. By examining these factors, the study aims to illuminate how social anxiety and envy influence health-risk behaviors related to appearance enhancement.

### Social anxiety and self-presentation

Leary (2014) [3], expanding on Self-Presentation Theory [4], argues that social anxiety in self-presentation serves as a crucial framework linking interpersonal motivation, social emotions, and self-concept. This perspective emphasizes that concerns about others' perceptions significantly influence social anxiety and its relationship to related emotions, such as envy.

Social anxiety manifests when individuals strive to make a positive impression but are uncertain about their capacity to do so [3]. From an evolutionary standpoint, maintaining social bonds was crucial for survival, leading to the development of mechanisms that protect interpersonal relationships [5, 6]. This relational value perspective suggests that social anxiety is both functional and essential for fostering connections [3]. According to sociometer theory, social anxiety acts as an early warning system for threats to one's relational value [3, 7]. Individuals with social anxiety typically exhibit heightened self-awareness, reflecting concerns about others' perceptions [8].

The value of interpersonal relationships is often tied to physical appearance, with attractive individuals receiving greater social favor [9]. Self-presentation is central to social interactions, as individuals strive to project an appealing image that enhances their social status [10]. This pursuit of societal beauty standards can lead to various appearance-enhancing behaviors like grooming and exercise, and in some cases, individuals may engage in risky practices despite potential health risks in order to achieve their aesthetic goals [11, 12].

From a gender perspective, women are typically more aware of and affected by social aesthetic standards, resulting in a higher tendency to engage in beauty-related risk-taking compared to men [2]. This likely reflects broader societal expectations, where women face more stringent beauty norms and pressures [11]. Therefore, this study exclusively focused on women—more precisely, cisgender women—based on theoretical and empirical considerations. We recognize, however, that this focus constitutes a limitation of the current study, as it may restrict the generalizability of the findings. This limitation will be addressed in the discussion section.

### Social anxiety and envy

We link social anxiety and envy through shared traits: self-focused concerns, low self-esteem, and feelings of

inferiority. We argue that envy uniquely influences the motivational and emotional processes of social anxiety, intensifying in contexts that trigger it. Additionally, envy may act as a by-product of social anxiety, further reinforcing feelings of inadequacy.

Envy is an unpleasant social emotion arising from negative social comparisons, feelings of self-inferiority, and potential hostility toward others perceived as superior [13]. While often negative, envy can drive individuals to address perceived disadvantages. According to Tesser (1988) [14], envy threatens self-evaluation and thereby prompts self-enhancement strategies [15]. Evolutionarily, envy signals a lower social position, motivating improvement in key personal areas [16, 17], and empirical studies confirm that it can motivate self-enhancement efforts [18, 19].

Social anxiety and the propensity for social comparison are closely linked, with higher anxiety often associated with more frequent comparisons [20], especially among those with low social status. High social anxiety individuals tend to face uncertainty about their self-concept [21], which in turn leads to increased social comparisons [22]. Social rank theory [23] posits that individuals with elevated social anxiety perceive social environments as inherently hierarchical, resulting in competitive interactions [5]. This perception suggests that feelings of inferiority from social comparisons contribute to social anxiety [24, 25]. Moreover, research indicates that upward appearance comparisons among adolescents are associated with increased social anxiety levels [26]. Those suffering from social anxiety engage in frequent unfavorable comparisons, which can heighten perceived inferiority and correlate strongly with envy [20, 27].

Additionally, research findings suggest that envy is positively correlated with generalized anxiety as well as its associated symptomatology, including anxiety, depression, and obsessive-compulsive tendencies [28]. Individuals with social anxiety typically experience envy characterized by upward comparisons, feelings of inferiority, and beliefs about others' superiority [13]. A diary study revealed that individuals with social anxiety disorder (SAD) reported higher envy levels compared to non-sufferers, particularly in social contexts [29]. These clinical conditions provide a theoretical framework for understanding the affective mechanisms that may also be evident in state social anxiety—a transient, situational response. Thus, although state social anxiety is not pathological per se, the similar emotional responses observed in clinical populations suggest that shared underlying processes may be at work. Importantly, while we reference clinical conditions of psychopathology research to provide a broader theoretical context, our primary focus is on state social anxiety—a temporary, situational

response that is far more prevalent in everyday life. We deliberately target state social anxiety in our experiments because this form of situational anxiety is not only prevalent but also theoretically significant. By focusing on state social anxiety, our aim is to elucidate the dynamic processes underlying social anxiety and its associated affective responses, such as envy.

Despite the correlation between envy and social anxiety, the literature lacks studies examining whether social anxiety-inducing situations can trigger envy. Understanding the contexts that elicit these emotions is essential for grasping psychiatric pathology and informing treatment [30]. We hypothesize that social anxiety elicits concurrent feelings of envy, influencing behavior related to self-presentation in such situations.

### **“Better body, Better self”**

The pursuit of beauty is often seen as a socially encouraged strategy for individuals dissatisfied with themselves, helping them seek acceptance and security. This drive motivates many to adopt body modification practices to align their appearance with personal and social ideals [31, 32]. Belk (1988) [33] asserts that “body parts are the most central part of the extended self,” emphasizing the body as an extension of the individual, whereby the physical form serves to present and represent the self to other people [34]. Unfortunately, modern women face pressure to achieve nearly unattainable beauty standards [35], often resorting to extreme measures like cosmetic surgery or substance use, even leading to cosmetic surgery addiction.

Appearance management involves conscious behaviors to control physical appearance [36], categorized into routine (e.g., grooming) and non-routine (e.g., cosmetic surgery) behaviors [37], with non-routine behaviors carrying significant health risks [38]. Goffman’s Dramaturgical theory highlights how individuals use physical appearance to shape social interactions [39]. Moreover, women’s social anxiety is frequently linked to concerns about their appearance, with heightened vigilance regarding their looks is associated with heightened anxiety in interpersonal contexts [40].

Envy is a motivational emotion that drives behavior [41, 42], especially among women seeking to enhance their appearance. Studies have demonstrated a correlation between self-reported envy and intentions to undergo cosmetic procedures [43]. Additionally, envy mediates the relationship between appearance comparisons and women’s attitudes toward enhancement [44]. The concept of Problem Behavior Syndrome [45] suggests that young people often engage in risky behaviors to improve their appearance, such as indoor tanning and unhealthy weight management [46]. This study considers minimally invasive skin treatments,

diet pill use, and cosmetic surgery as key aspects of non-routine appearance management behaviors, each carrying risks and significantly impacting one’s appearance.

### **The present study**

This study seeks to enhance our comprehension of envy within the context of social anxiety and its role as a motivator in non-routine appearance management behaviors (AMBs). In Study 1, we employed two experimental paradigms to manipulate state social anxiety. Study 1a utilized the impromptu speech task to induce anxiety and measured state envy, cosmetic surgery interest, willingness to try minimally invasive procedures, and use of health-risk diet pills. Study 1b replicated these findings using the free recall task, expanding the dependent variables to include specific cosmetic surgery procedures. Study 2 used a written guided imagery procedure to experimentally manipulate envy and examine its direct impact on non-routine behaviors. The study was ethically approved and all participants’ rights were protected.

In summary, we hypothesized that: (1) participants in the high social anxiety condition would exhibit higher levels of envy than those in the control condition (H1; tested in Study 1); (2) participants in the high social anxiety condition would demonstrate an increase in non-routine AMBs than those in the control condition (H2; tested in Study 1); and (3) envy would mediate the relationship between social anxiety and non-routine AMBs (H3; examined in Study 1 and 2).

### **Study 1**

The aim of Study 1 was to investigate the influence of state social anxiety on non-routine AMBs, focusing on the mediating role of envy. In Study 1, we employed two distinct experimental paradigms to manipulate state social anxiety. Study 1a utilized an impromptu speech task—a classic method that induces anxiety in a controlled setting by exposing participants to a situation of social evaluation—resulting in relatively uniform anxiety responses. Conversely, Study 1b employed a free recall task, wherein participants were asked to recall personal experiences of social anxiety. Although this approach introduces more variability, it enhances ecological validity by reflecting real-world experiences. By combining these paradigms, we were able to replicate our hypotheses under varied conditions, thereby enhancing the overall robustness and generalizability of our findings.

### **Study 1a**

#### **Method**

#### **Participants**

Based on the G\*Power 3.1 analysis [47], at least 90 participants are required for a statistical power of 0.80

(a  $p$ -value of 0.05), assuming a moderate effect size ( $f = 0.30$ ). In total, 140 women were recruited from Credamo (an online survey collection platform similar to MTurk) in China ( $M_{\text{age}} = 24.34$  years,  $SD = 5.10$ ). Body mass index (BMI) ranged between 15.57–29.41 ( $M = 20.46$ ,  $SD = 2.69$ ). The group included 17% ( $n = 24$ ,  $BMI \leq 18.5$ ) underweight, 72% ( $n = 101$ ,  $18.5 < BMI < 24$ ) with normal weight, 8% ( $n = 11$ ,  $BMI \geq 24$ ) overweight, and 3% ( $n = 4$ ,  $BMI \geq 28$ ) obese. The survey included two items to check attention and no participants were excluded.

### Procedure and materials

The experiment was conducted online. Before beginning, all participants provided informed consent. Participants were randomly assigned to either the high social anxiety condition or the control condition and underwent the corresponding social anxiety manipulation. Immediately afterward, state anxiety was assessed using the Subjective Units of Distress Scale (SUDS) to verify the effectiveness of the manipulation. Participants then completed the state envy measure to capture their affective responses. Finally, participants reported their intentions regarding non-routine AMBs, including attitudes toward cosmetic surgery and other attractiveness-enhancing risky events. Demographic variables and other relevant information were collected at the conclusion of the experiment.

**Social anxiety manipulation** Social anxiety was experimentally induced using the procedure adapted from Brown and Kocovski (2014) [48]. Participants assigned to the high social anxiety condition were required to deliver a three-minute impromptu speech, for which they were had to prepare an introduction. The task has been shown to induce social anxiety [48]. Participants assigned to the control condition were not asked to perform any tasks. Participants were randomly allocated to the high social anxiety condition ( $N = 70$ ) or the control condition ( $N = 70$ ).

**Anxiety measurement** The Subjective Units of Distress Scale (SUDS) [49] was adopted to measure state anxiety. Participants were asked to assign a number to their current subjective experience of anxiety, ranging from 0 (no distress, tension and/or anxiety) to 100 (maximum possible stress, tension and/or anxiety).

**Envy measures** The state envy measure was adapted from Hill et al. (2011) [17]. Participants responded to 10 items using a 7-point scale (1 = *not at all*, 7 = *very much*). Participants were asked to rate the following emotional

characteristics based on their current feelings (“dissatisfied with self,” “envious,” “hostile,” “inferior,” “longing for what another has,” “mediocre,” “motivation to improve,” “resentful,” “unlucky,” and “wishful”;  $\alpha = 0.88$ ), which have been found to be highly correlated with the emotion of envy [13].

**Non-routine appearance management behaviors (AMBs)** Participants reported their attitudes toward cosmetic surgery and other attractiveness-enhancing risky events (including injecting whitening agents into the skin and taking diet pills that may cause illness) measuring non-routine behaviors.

**Cosmetic surgery.** Participants indicated how likely they would be to improve appearance with plastic surgery (e.g., “In the future, I could end up having some kind of cosmetic surgery”;  $\alpha = 0.84$ ) with two items. These measures of interest in cosmetic surgery are based on the Consider subscale of the Acceptance of Cosmetic Surgery Scale (ACSS) [50]. Participants responded on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*).

**Other attractiveness-enhancing risky events.** Participants were asked to indicate whether they would be willing to undertake risky projects aimed at enhancing physical attractiveness. Participants rated their agreement with two items adapted from Hill and Durante (2011) [51] on a 7-point scale (1 = *not at all interested*, 7 = *very interested*) (e.g., “Are you interested in taking a diet pill known to cause heart problems later in life”;  $\alpha = 0.37$ ). The scores for these two items were combined and processed as a total score for statistical convenience. The composite AMB measures demonstrated a Cronbach’s  $\alpha$  reliability of 0.63.

## Results

### Manipulation check

The findings demonstrated that participants in the high social anxiety condition exhibited elevated levels of state anxiety ( $M_{\text{high social anxiety}} = 33.84$ ,  $SD = 29.15$ ;  $M_{\text{control}} = 20.39$ ,  $SD = 22.59$ ;  $t(138) = 3.05$ ,  $p = 0.003$ , Cohen’s  $d = 0.52$ ) compared to those in the control condition.

### Envy

A one-way analysis of variance was employed to ascertain the influence of social anxiety (high = 1, control = 0) on envy, controlling for age and BMI. The results confirmed that social anxiety had a significant main effect on the perception of envy ( $F(1, 136) = 26.09$ ,  $p < 0.001$ ,  $\eta^2_p = 0.161$ ;  $M_{\text{high social anxiety}} = 29.53$ ,  $SD = 11.14$ ;  $M_{\text{control}} = 20.81$ ,  $SD = 8.71$ ). As expected, women in the high social anxiety condition reported higher levels of envy. This support for Hypothesis 1.



### Non-routine AMBs

A one-way analysis of variance was employed to examine the effect of social anxiety (high = 1, control = 0) on non-routine behaviors, controlling for age and BMI. The results confirmed that social anxiety exerted a marginally significant main effect on the women's willingness to embrace attractiveness-enhancement risks ( $F(1, 136) = 3.72$ ,  $p = 0.056$ ,  $\eta^2_p = 0.027$ ). Nevertheless, no significant differences were identified between the two conditions in the women's interest in cosmetic surgery ( $p = 0.922$ ). This partly support for Hypothesis 2.

### Mediating effect of envy

In light of the aforementioned findings, we further examine the mediating effect of envy on the relationship between social anxiety (high = 1, control = 0) and non-routine behaviors. To test the underlying process of our predictions, Model 4 of the PROCESS macro (bias-corrected bootstrap = 5000) [52] was adopted to test the mediating role of envy (see Fig. 1), controlling for age and BMI.

The analyses and bootstrapping results demonstrated that the indirect effect of social anxiety (high vs. low) on women's interest in cosmetic surgery ( $\beta_{\text{indirect}} = 1.12$ ,  $SE = 0.25$ , 95% CI = [0.65, 1.65]) and willingness to take other attractiveness-enhancement risks ( $\beta_{\text{indirect}} = 0.56$ ,  $SE = 0.21$ , 95% CI = [0.21, 1.02]) through envy was significant. Furthermore, the direct effect of social anxiety on women's willingness to undertake attractiveness-enhancement risks was found to be non-significant when envy was incorporated into the model ( $\beta = 0.20$ ,  $SE = 0.42$ , 95% CI = [-0.62, 1.03]). The findings indicated a positive association between social anxiety and envy, which in turn was correlated with an increase in non-routine AMBs among women, supporting all the Hypotheses.

### Study 1b

#### Method

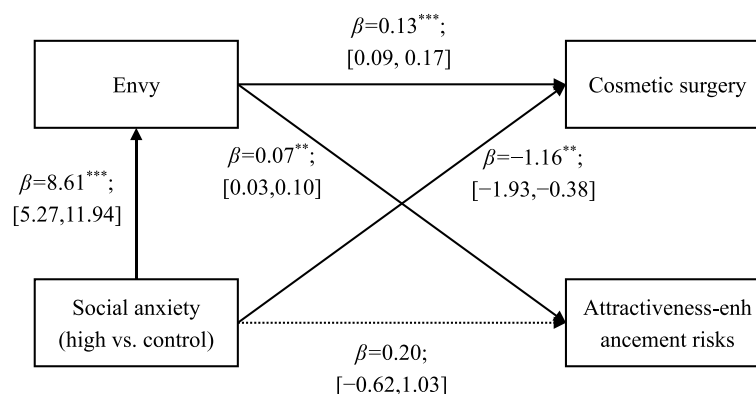
##### Participants

Based on the G\*Power 3.1 analysis [47], at least 90 participants are required for a statistical power of 0.80 (a  $p$ -value of 0.05), assuming a moderate effect size ( $f = 0.30$ ). In total, 162 women were recruited from Credamo in China ( $M_{\text{age}} = 23.60$ ,  $SD = 3.54$ ). Body mass index (BMI) ranged between 14.87–29.41 ( $M = 20.02$ ,  $SD = 2.36$ ). The group included 27.8% ( $n = 45$ ,  $BMI \leq 18.5$ ) underweight, 66.7% ( $n = 101$ ,  $18.5 < BMI < 24$ ) with normal weight, 4.9% ( $n = 8$ ,  $BMI \geq 24$ ) overweight, and 0.6% ( $n = 1$ ,  $BMI \geq 28$ ) obese. Three participants were removed from the sample for failing one of the two attention checks.

##### Procedure and materials

Study 1b followed a parallel procedure to Study 1a, with the experiment conducted online. Before beginning, all participants provided informed consent. Participants were randomly assigned to either the high or low social anxiety condition and underwent the corresponding social anxiety manipulation. Immediately afterward, state anxiety was assessed to verify the effectiveness of the manipulation. Participants then completed the state envy measure to capture their affective responses. Finally, participants reported their intentions regarding non-routine AMBs, including attitudes toward cosmetic surgery, specific cosmetic procedures, and other attractiveness-enhancing risky events. Demographic variables and other relevant information were collected at the conclusion of the experiment.

**Social anxiety manipulation** Experimental induction of social anxiety was conducted using the procedure adapted from Magee and Zinbarg (2007) [53]. Participants in the high state social anxiety condition were



**Fig. 1** Mediation model of envy (Study 1a). Note.  $**p < 0.01$ ,  $***p < 0.001$

requested to recall a previous negative social interaction with a stranger that had caused them distress. Participants were required to provide detailed responses in three sections (“Describe the situation: the participants and a basic summary of the interaction.”, “What feelings and sensations did you experience during the negative interaction?” and “How do you think others perceived you during the interaction? In other words, how would you have looked to the other person/people in the interaction or to any outside observer?”). Participants in the low social anxiety condition were requested to recall a past positive social interaction with a stranger, which made them feel relaxed. They received instructions similar to those given in the experimental condition. Participants were randomly assigned to either the high social anxiety condition ( $N = 79$ ) or the low social anxiety condition ( $N = 83$ ).

**Anxiety measurement** The state anxiety assessment was adapted from Vriends et al. (2011) [54]. Participants were required to respond to 4 items (“absolutely not nervous-very nervous”, “absolutely not stressed-very stressed”, “absolutely not calm-very calm” and “absolutely not relaxed-very relaxed”;  $\alpha = 0.89$ ) on a 9-point scale (the larger the number, the deeper the degree) according to their real feelings at the moment.

**Envy measures** Participants responded to 10 items measuring state envy using a 7-point scale (1 = *not at all*, 7 = *very much*;  $\alpha = 0.86$ ) (as in Study 1a).

**Non-routine AMBs** Participants reported their attitudes toward cosmetic surgery, cosmetic surgery procedures, and other attractiveness-enhancement risky events measuring non-routine behaviors. In Study 1a, we utilized the Consider subscale of the Acceptance of Cosmetic Surgery Scale [50] to capture participants’ overarching attitudes toward cosmetic procedures, specifically assessing their overall inclination to consider such interventions. For Study 1b, we integrated an additional measure of consider of cosmetic surgery [55], which was designed to evaluate the likelihood of engaging in specific cosmetic interventions. This procedure-specific instrument offered a detailed assessment that complemented the general attitudinal measure. We believe this dual measurement approach, in conjunction with measures of other risk behaviors, more effectively captures the construct validity of non-routine AMBs.

**Cosmetic surgery.** Interest in cosmetic surgery was evaluated using the Consider subscale of the Acceptance of Cosmetic Surgery Scale [50]. Participants responded to 5 items (e.g., “I have sometimes thought about

having cosmetic surgery”;  $\alpha = 0.93$ ) on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*).

**Cosmetic surgery procedures.** Another measurement of consider of cosmetic surgery was adapted from Markey and Markey (2009) [55]. Participants were asked “If cost were not an issue, how likely would you be to do each of the following to improve your appearance?”. A list of 5 cosmetic surgery procedures was listed, and the participants were asked to rate each on a 5-point scale (1 = *I would never consider this procedure*, 5 = *I would definitely consider this procedure*). The list of procedures was derived from the five most popular procedures worldwide presented by the International Society of Aesthetic Plastic Surgery (ISAPS) World Congress (2022 data: Liposuction procedures, Breast Augmentation, Eyelid Surgery, Abdominoplasty, Breast Lift;  $\alpha = 0.87$ ).

**Other attractiveness-enhancement risky events.** Participants were requested to indicate their interest in engaging in risky projects aimed at enhancing physical attractiveness with two items on a 7-point scale (1 = *not at all interested*, 7 = *very interested*;  $\alpha = 0.43$ ) (as in Study 1a). The composite AMB measures demonstrated a Cronbach’s  $\alpha$  reliability of 0.92.

## Results

### Manipulation check

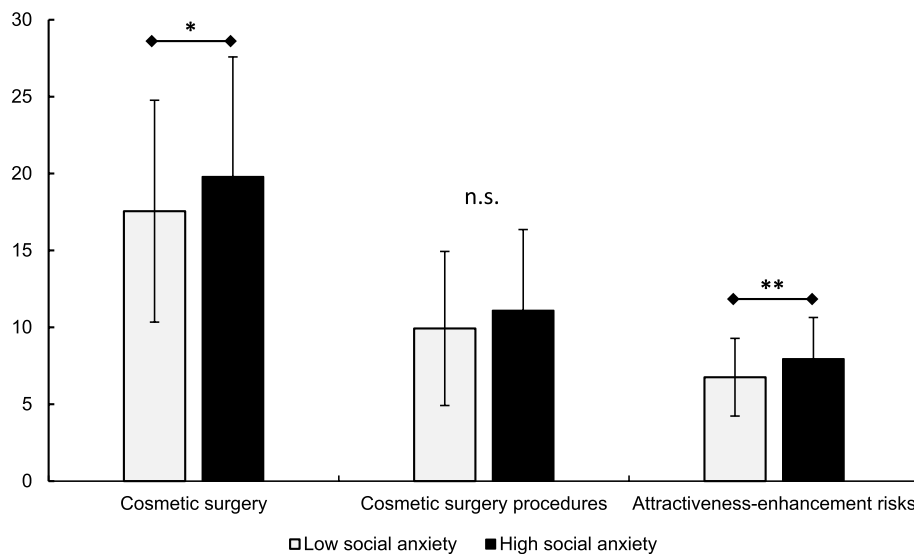
The results demonstrated that participants in the high social anxiety condition exhibited elevated levels of state anxiety ( $M_{\text{high social anxiety}} = 18.53$ ,  $SD = 9.05$ ;  $M_{\text{low social anxiety}} = 11.80$ ,  $SD = 7.38$ ;  $t(160) = 5.20$ ,  $p < 0.001$ , Cohen’s  $d = 0.82$ ) compared to those in the control condition.

### Envy

A one-way analysis of variance was conducted to examine the impact of social anxiety (high = 1, low = 0) on envy, controlling for age and BMI. The results confirmed that social anxiety exerted a significant main effect on the perception of envy ( $F(1, 158) = 39.41$ ,  $p < 0.001$ ,  $\eta^2_p = 0.200$ ;  $M_{\text{high social anxiety}} = 34.33$ ,  $SD = 10.68$ ;  $M_{\text{low social anxiety}} = 25.06$ ,  $SD = 8.08$ ). As anticipated based on the findings of Study 1a, women in the high social anxiety condition reported higher levels of envy. This support for Hypothesis 1.

### Non-routine AMBs

A one-way analysis of variance was conducted to investigate the influence of social anxiety (high = 1, low = 0) on non-routine behaviors, controlling for age and BMI (see Fig. 2). The findings confirmed that social anxiety had a significant main effect on the women’s interest in cosmetic surgery ( $F(1, 158) = 4.22$ ,  $p = 0.042$ ,  $\eta^2_p = 0.026$ ) and proclivity towards other attractiveness-enhancement risks ( $F(1, 158) = 11.32$ ,  $p = 0.001$ ,  $\eta^2_p = 0.067$ ).



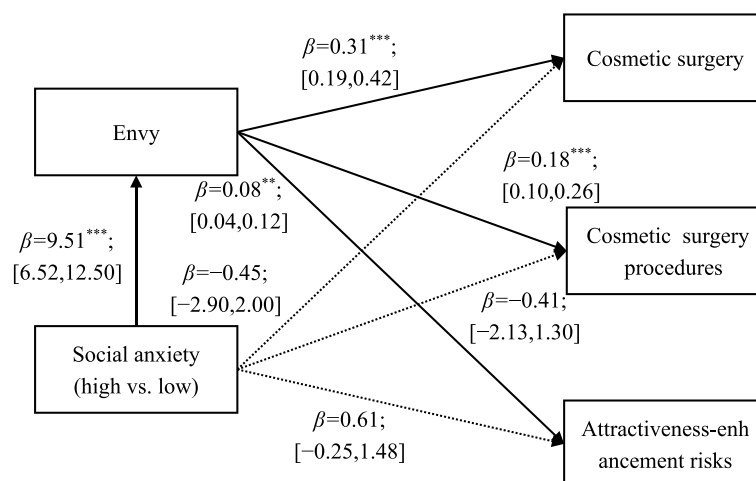
**Fig. 2** Mean score for participants in non-routine appearance management behaviors following a social anxiety manipulate or a neutral task (Study 1b). Note. \* $p < 0.05$ , \*\* $p < 0.01$ , n.s. = non-significant

Nevertheless, no significant differences were observed between the two conditions in the women's consideration of cosmetic surgery procedures ( $p = 0.118$ ). This partly support for Hypothesis 2.

#### Mediating effect of envy

Based on the aforementioned results, we proceeded to analyze the mediating effect of envy on the relationship between social anxiety (high = 1, low = 0) and non-routine behaviors. To test the underlying process of our predictions, Model 4 of the PROCESS macro (bias-corrected bootstrap = 5000) [52] was adopted to test the mediating role of envy (see Fig. 3), controlling for age and BMI.

The results indicated that the indirect effect of social anxiety (high vs. low) on women's interest in cosmetic surgery ( $\beta_{\text{indirect}} = 2.91$ ,  $SE = 0.73$ , 95% CI = [1.64, 4.56]), consideration of cosmetic surgery procedures ( $\beta_{\text{indirect}} = 1.7$ ,  $SE = 0.43$ , 95% CI = [0.94, 2.65]), and willingness to take other attractiveness-enhancement risks ( $\beta_{\text{indirect}} = 0.77$ ,  $SE = 0.22$ , 95% CI = [0.37, 1.24]) through envy was significant. Furthermore, the direct effect of social anxiety on women's interest in cosmetic surgery ( $\beta = -0.45$ ,  $SE = 1.24$ , 95% CI = [-2.90, 2.00]), consideration of cosmetic surgery procedures ( $\beta = -0.41$ ,  $SE = 0.87$ , 95% CI = [-2.13, 1.30]), and willingness to take attractiveness-enhancement risks ( $\beta = 0.61$ ,  $SE = 0.44$ , 95% CI = [-0.25,



**Fig. 3** Mediation model of envy (Study 1b). Note. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

1.48]) was not significant upon the inclusion of envy in the model. The findings of this study further provided empirical support for all Hypotheses.

## Study 2

In Study 1, two distinct experimental approaches for manipulating social anxiety were employed to test the hypotheses. It should be noted, however, that the experience of envy (mediating variable) was assessed passively, through self-report measures, rather than being actively manipulated in the experiment. Therefore, the objective of Study 2 was to directly test the effect of envy on non-routine appearance management behaviors, further supporting the mediating role of envy in the relationship between social anxiety and these behaviors, as observed in Study 1. We manipulated envy using a written memory recall task to investigate its impact on non-routine behaviors.

## Method

### Participants

Based on the G\*Power 3.1 analysis [47], at least 90 participants are required for a statistical test power of 0.80 (a  $p$ -value of 0.05), assuming a moderate effect size ( $f = 0.30$ ). In total, 99 participants were recruited from Credamo in China ( $M_{\text{age}} = 25.16$ ,  $SD = 5.61$ ). Body mass index (BMI) ranged between 15.24–29.41 ( $M = 20.09$ ,  $SD = 2.64$ ). The group included 26.3% ( $n = 26$ ,  $BMI \leq 18.5$ ) underweight, 68.7% ( $n = 101$ ,  $18.5 < BMI < 24$ ) with normal weight, 1% ( $n = 1$ ,  $BMI \geq 24$ ) overweight, and 4% ( $n = 4$ ,  $BMI \geq 28$ ) obese. One participant was disqualified from the sample after failing one of the two attention checks.

### Procedure and materials

The experiment was conducted online. Prior to the experiment, all participants provided informed consent. Participants were randomly assigned to either the envy condition or the control condition and underwent the corresponding experimental manipulation. Immediately afterward, state envy was assessed to verify the effectiveness of the manipulation. Finally, participants reported their intentions regarding non-routine AMBs, including attitudes toward cosmetic surgery, specific cosmetic procedures, and other attractiveness-enhancing risky events. Demographic variables and other relevant information were collected at the conclusion of the experiment.

**Envy manipulation** Envy was experimentally induced using the recall writing task procedure adapted from Hill et al. (2011) [17]. Participants in the experimental condition were required to write down four situations in which they were envious of a friend or acquaintance. Participants in the control condition were instructed to record

their daily activities. Participants were then required to write down one of these events in detail within 10 min. As a manipulation check, participants needed to answer three items designed to assess their current levels of envy towards the partner (e.g., “I envy the person”;  $\alpha = 0.88$ ) on a 7-point scale (1 = *does not apply at all*, 7 = *applies strongly*) (adapted from Lange et al., 2020 [56]). The participants were randomly assigned to the either high envy condition ( $N = 50$ ) or the control condition ( $N = 49$ ).

**Non-routine AMBs** Participants answered a series of questions designed to measure non-routine behaviors, these measurements are the same as in study 1b.

**Cosmetic surgery.** Participants responded to the Consider subscale of the Acceptance of Cosmetic Surgery Scale [50] with 5 items on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*;  $\alpha = 0.93$ ).

**Cosmetic surgery procedures.** Participants were asked to rate a list of 5 cosmetic surgery procedures on a 5-point scale (1 = *I would never consider this procedure*, 5 = *I would definitely consider this procedure*;  $\alpha = 0.83$ ).

**Other attractiveness-enhancement risky events.** Participants were requested to indicate their willingness to undertake risky projects aimed at enhancing physical attractiveness with two items on a 7-point scale (1 = *not at all interested*, 7 = *very interested*;  $\alpha = 0.37$ ). The composite AMB measures demonstrated a Cronbach's  $\alpha$  reliability of 0.92.

## Results

### Manipulation check

The results demonstrated that participants in the envy condition exhibited elevated levels of state envy ( $M_{\text{envy}} = 17.16$ ,  $SD = 2.53$ ;  $M_{\text{control}} = 7.22$ ,  $SD = 4.19$ ;  $t(97) = 14.31$ ,  $p < 0.001$ , Cohen's  $d = 2.87$ ) than those in the control condition.

### Non-routine AMBs

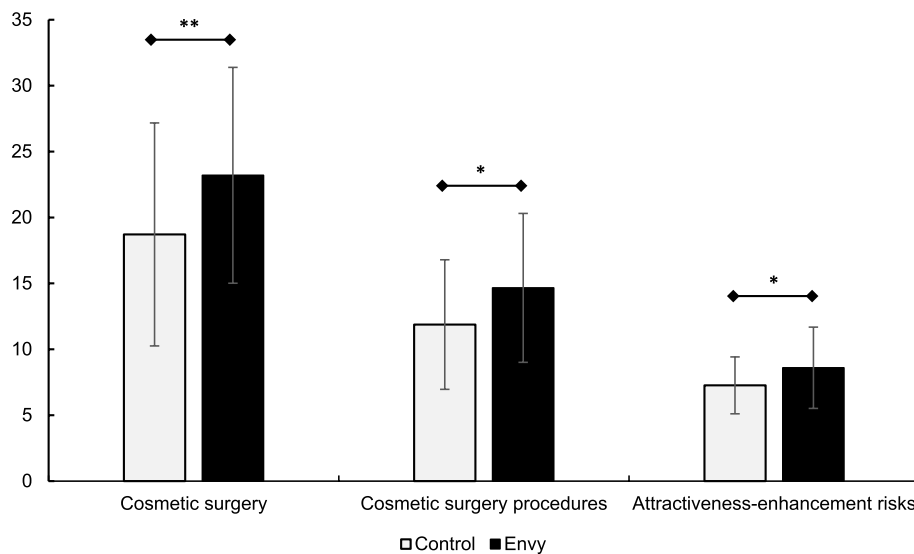
A one-way analysis of variance was conducted to investigate the influence of envy (high = 1, control = 0) on non-routine behaviors, controlling for age and BMI (see Fig. 4). The results confirmed that envy had a significant main effect on the women's interest in cosmetic surgery ( $F(1, 95) = 7.25$ ,  $p = 0.008$ ,  $\eta^2_p = 0.071$ ), consideration of cosmetic surgery procedures ( $F(1, 95) = 6.95$ ,  $p = 0.010$ ,  $\eta^2_p = 0.068$ ), and take attractiveness-enhancement risks ( $F(1, 95) = 6.23$ ,  $p = 0.014$ ,  $\eta^2_p = 0.062$ ).

The findings provide empirical support for Hypothesis 3.

## General discussion

The results largely corroborated the hypotheses that had been formulated. Participants reported elevated levels of envy in social anxiety-inducing situations and exhibited a





**Fig. 4** Mean score for participants in non-routine appearance management behaviors following an envy manipulate or a neutral task (Study 2). Note: \* $p < 0.05$ , \*\* $p < 0.01$

greater tendency to engage in strict appearance management, even at potential risks. We attribute this effect to the interplay between social anxiety and envy, with envy playing a key motivational role.

Specifically, both Studies 1a and 1b, which employed distinct experimental paradigms to manipulate social anxiety, revealed that individuals in high social anxiety contexts experienced heightened levels of envy. This finding aligns with prior research linking envy to generalized anxiety symptoms [28]. Social anxiety has been shown to be positively associated with increased envy across all fundamental characteristics [13], and empirical studies further indicate that socially anxious individuals experience greater envy in social situations [29]. Given the detrimental effects of envy on well-being [57] and its various negative consequences [13], it is plausible that envy may exacerbate the development of social anxiety. Thus, addressing envy within the framework of social anxiety is of crucial importance.

A core premise underlying our hypothesis about the relationship between social anxiety and envy is the concern for social comparison, or sensitivity to social hierarchy, fosters and sustains negative self-representation. Research consistently demonstrates a positive correlation between social comparison tendencies and social anxiety [20]. Individuals with social anxiety are particularly sensitive to social hierarchy cues, and often feeling inferior, especially in anxiety-inducing situations. At the heart of social anxiety lies a perception of social ineptitude and a belief in self-inferiority (i.e., “I am not as good as others”). Similarly, envy arises from unfavorable upward comparisons, reinforcing a negative self-other disparity. Recent

studies suggest that both envy and its subtypes are driven by feelings of inferiority [41]. This sense of inferiority or disadvantage creates an ideal breeding ground for the co-occurrence of social anxiety and envy.

An additional perspective for enhancing our understanding of the intrinsic interconnection between envy and social anxiety is through an evolutionary lens. Social comparison and evolutionary dynamics are closely intertwined, as a lower social standing may signal compromised access to vital resources, posing survival risks. While anxiety may function as a more fundamental emotional directive, envy adds an additional layer of complexity. Both theoretical frameworks suggest that envy can be adaptive, and the painful experience of envy alerts individuals to potential threats to their self-evaluation or highlights perceived disadvantages in important resource acquisition, thereby motivating compensatory actions aimed at self-improvement [16].

The evolutionary theory of self-presentation posits that although anxiety is inherently unpleasant, it serves to protect individuals’ interpersonal interests by facilitating social anxiety. Typically, individuals strive to project a positive self-image that aligns with societal expectations [3]. Prior research has demonstrated that concerns about appearance are closely associated with social anxiety [2, 40]. Our findings suggest that envy serves as a motivational force, prompting individuals to enhance their self-presentation as a strategy to mitigate social anxiety.

Dissatisfaction with oneself is often addressed through appearance-oriented management. Individuals manage their bodies and control their overall appearance to

convey construct and communicate desired identities [2]. This process may involve minimally invasive treatments or more extreme measures like cosmetic surgery, turning the body and appearance into vehicles for self-expression, enabling individuals to reflect on, modify, and reconstruct their self-concepts, potentially even reconstructing their self-identity [58].

In our study, we adopted a dual-measure approach to assess cosmetic surgery intentions. Specifically, we employed the Consider subscale of the Acceptance of Cosmetic Surgery Scale to capture general attitudes, and an additional instrument measurement about cosmetic procedures to gauge the likelihood of undergoing specific cosmetic procedures. This strategy enabled us to cross-validate our findings and capture nuanced differences in participants' responses, thereby strengthening the construct validity of our measurement. Furthermore, our investigation extended beyond cosmetic surgery by including measures of other attractiveness-enhancing risky behaviors. This comprehensive assessment enabled us to explore how state social anxiety and associated feelings of envy contribute not only to a generalized interest in altering one's appearance but also to distinct behavioral choices across a spectrum of risk-related practices. Together, these findings underscore the multifaceted nature of appearance management behaviors and highlight the importance of considering multiple measurement approaches when examining the complex interplay between social anxiety, envy, and risk-related outcomes.

An important contribution of our work is the use of two distinct experimental paradigms to manipulate state social anxiety. The impromptu speech task offers a controlled environment that elicits consistent anxiety responses, facilitating precise hypothesis testing. Conversely, the free recall task captures more ecologically valid experiences of state social anxiety, enhancing the generalizability of our findings. Crucially, the replication of effects across these paradigms bolsters confidence in the robustness of our results, demonstrating that the relationship between social anxiety and envy-driven behaviors is not confined to specific experimental conditions. Together, these paradigms enable cross-validation of our findings, strengthen construct validity, and provide a comprehensive understanding of how social anxiety and its associated affective responses, such as envy, influence appearance management behaviors.

In summary, this study highlights the mediating function of envy in the relationship between social anxiety and behavioral motivation. From a theoretical perspective, it deepens our understanding of social anxiety's impact on self-presentation and its close relationship with envy. These findings contribute to the theoretical

framework and empirical research on SAD, particularly in light of the growing focus on emotions in SAD research [59]. Although this study did not include clinical SAD individuals, the insights gained may still offer valuable implications.

From a practical standpoint, our findings underscore numerous future research directions on how social anxiety interacts with other discrete emotions, affecting individuals' psychological and behavioral health. By understanding the mechanisms underlying social anxiety can inform the development of more effective interventions. Since individuals with social anxiety often experience concerns about negative impressions others may form, counseling could focus on clients' self-presentation concerns. Recognizing the adaptive significance of social anxiety as a means to mitigating social rejection and emphasizing relational value, and then more appropriately understand and handle other emotions that arise in this process (e.g., envy), may enhance therapeutic outcomes [3], which is also applicable in contexts like cosmetic surgery addiction.

A notable limitation of this study is its exclusive focus on cisgender women. Our decision to restrict the sample to this group was driven by theoretical and empirical evidence suggesting that women are particularly sensitive to social aesthetic standards and thus more likely to engage in beauty-related risk-taking behaviors. However, this focus may limit the generalizability of our findings, as the mechanisms linking social anxiety, envy, and appearance management behaviors might operate differently in men or gender-diverse populations. Future research should extend this investigation to include these groups to determine whether similar patterns emerge and to provide a more comprehensive understanding of the interplay between social anxiety and envy across different gender identities.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40359-025-02869-9>.

Supplementary Material 1.

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Not applicable.

## Authors' contributions

CY: Conceptualization, Methodology, Formal analysis, Visualization, Writing-original draft, Writing-review & editing, Supervision. XY: Conceptualization, Formal analysis, Writing-original draft. YQL: Material preparation, Data collection. All authors reviewed the manuscript.

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## Data availability

Data is provided within the supplementary information files.

## Declarations

### Ethics approval and consent to participate

The study was approved by the Ethics Committee of School of Psychology, Fujian Normal University. All relevant ethical safeguards have been met with regard to subject protection. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

### Consent for publication

Written informed consent for publication was obtained from all participants.

### Competing interests

The authors declare no competing interests.

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