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RESEARCH ARTICLE

'Large Is Beautiful!' Associative Retraining Changes Implicit Beliefs About Thinness and Beauty and Decreases Women's Appearance Anxiety

Leila Selimbegovic*, Julie Collange†, Yvana Bocage-Barthélémy* and Armand Chatard*

The present research aimed to investigate whether retraining thin-beautiful associations could modify implicit beliefs relating thinness to beauty, increase me-beauty associations, and decrease explicit body anxiety in young women. In Experiment 1 (N = 180 women), participants were repeatedly exposed to beauty-related words paired with thin-related or large-related words on 50% (control) versus 75% (retraining) of trials. Implicit belief was assessed with a Relational Responding Task. In Experiment 2 (N = 195 women), me-beauty associations were assessed with a single-category Implicit Association Task, and body anxiety with a self-report measure. The implicit association measure remained unaffected by the retraining task. However, after retraining, women displayed weaker thin-is-beautiful implicit belief, Cohen's $d = 0.44$, $CI_{95}[0.14, 0.74]$, and less body anxiety, Cohen's $d = 0.34$, $CI_{95}[0.06, 0.63]$ than in the control condition. These results suggest that retraining thin-beautiful associations could reduce thin-is-beautiful implicit beliefs and decrease explicit body anxiety among women.

Keywords: thin ideal; implicit beliefs; appearance anxiety; retraining; semantic associations

Many women believe that they must be thin to be beautiful (Grogan, 2006). In comparison to men, women more heavily invest in and have more negative body image (Davis et al., 2020; Muth & Cash, 1997; Quittkat et al., 2019). This is associated with many undesirable outcomes, such as anxiety and unhealthy behaviors such as smoking, binge eating, physical inactivity, unhealthy diet, intentional vomiting, consumption of laxative, diuretic, or weight loss pills, and even suicide attempts in adolescents (Cash et al., 2004; Neumark-Sztainer et al., 2006; Rodríguez-Cano et al., 2006). Therefore, developing efficient ways to maintain a positive body image is a worthy pursuit for both theoretical and practical reasons. In the present work, we examined one potentially efficient strategy: the modification of semantic associations between thinness and beauty. We reasoned that if this association is weakened, then the implicit belief that thinness is a defining attribute of female beauty will also be attenuated. Further, if such a belief plays an important role in shaping women's body image concerns, then the techniques used to weaken the thin-beautiful association should also affect self-perception in terms of physical attractiveness and preoccupation with physical appear-

ance. In what follows, we first discuss how the high standards of female thinness are internalized, and how this internalization could be changed through semantic retraining. Then, we present two studies conducted to test the effect of retraining on relevant beliefs and body image concerns, in terms of both implicit and explicit outcomes.

The High Standards of Female Beauty

Women's negative body image has often been traced to overly high and even unattainable standards of beauty that glorify thinness as a paramount criterion of beauty (Malkin et al., 1999; Silverstein et al., 1986; Slater et al., 2012; Sypeck et al., 2006). Indeed, exposure to the thin ideal starts at a very early age: girls are exposed to toys (e.g., Barbie) and cartoon characters (e.g., Disney princesses) that reinforce the idea that to be beautiful, a girl has to be thin. In fact, preoccupation with appearance occurs as early as five to eight years old among young girls (Grogan, 2006). Cultural pressures for gender conformity intensify at the onset of puberty, which further pushes young women to internalize thinness as a standard of beauty (Hill & Lynch, 1983; Thompson & Stice, 2001). In line with this idea, Helfert and Warschburger (2013) have recently shown that girls are particularly prone to feel appearance-related peer pressures, especially from early to middle adolescence. In fact, research shows that exposure to the thin ideal in the media is related to high body dissatisfaction, thin ideal internalization, body anxiety, eating disorders, depressive symptoms, low self-esteem, and increased accessibility of

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negative thoughts (Bessenoff, 2006; Balcetis et al., 2013; Chatard & Selimbegović, 2011; Dittmar & Howard, 2004; Halliwell & Dittmar, 2004; Harrison, 2001; Harrison & Cantor, 1997; Heinberg & Thompson, 1995; Stice et al., 1994; Thornton & Maurice, 1997; for meta-analyses, see Grabe et al., 2008; Groesz et al., 2002; Want, 2009). Therefore, considering that thinness is a necessary characteristic of female beauty seems to play a significant role in a number of problematic thought and behavior patterns.

Recent experimental evidence suggests that these effects can occur unconsciously and in a resource-independent manner (Bocage-Barthélémy et al., 2018; Bocage-Barthélémy et al., 2018; Chatard et al., 2017). Consistent with this idea, it has been demonstrated that young women tend to automatically evaluate body-related images (Watts et al., 2008; see also Watts & Cranney, 2010), as reflected in an affective prime task. This task involves categorizing target stimuli as positive or negative, each target stimulus being preceded by a prime pretested as positive or negative. Faster responses to congruent (both prime and target positive or both negative) than to incongruent trials (prime positive/target negative or prime negative/target positive) indicates automatic (unintentional) evaluation. Importantly, in the set of body-related primes in Watts et al.'s (2008, 2010) studies, words such as 'fat', 'obesity', or 'cellulite' were used as negative primes. In the same vein, Bessenoff and Sherman (2000) have shown that participants were faster to correctly recognize negative words after being briefly (15 ms) exposed to pictures of corpulent women than of thin women. This cluster of findings strongly suggests that automatic (i.e., unconscious and unintentional) associations in memory between relevant concepts play a pivotal role in fostering negative body image. Thus, altering semantic associations is likely to have downstream effects on other relevant constructs, such as beliefs and self-perception.

In sum, the present work has the potential to bring at least two theoretical contributions. First, it could experimentally demonstrate that the semantic association between thinness and (female) beauty plays a causal role in certain dysfunctional thought patterns. Second, if modifying association strength impacts beliefs and emotions, this work would imply that mere co-occurrence of semantic stimuli influences complex cognition and thought patterns with relatively important consequences for women's well-being. These insights can further be used to extend theories of body image, and elaborate practical applications in advertising and therapy.

Retraining Associations

If associating thinness with beauty is indeed a causal factor of vulnerability to adverse outcomes, then breaking or attenuating this association should have positive consequences on women's dysfunctional beliefs and body image. Consistent with this, research suggests that one of the most efficient ways of changing implicit attitudes is through repeated exposure to counter-stereotypic exemplars (Kawakami et al., 2000; Lai et al., 2016). Based on the idea that it is possible to weaken the automatic activation

of stereotypes through a learning process, Kawakami and collaborators conducted three experiments to investigate the effects of associative retraining on automatic stereotype activation. They tested the idea issued from prior work on skill acquisition that extensive practice leads to automatized processing, and that negating stereotyped associations and affirming counter-stereotypical ones would attenuate the strength of automatic stereotyping. In three studies, participants were trained to negate specific stereotypes by pressing a 'no' button when the pair of stimuli appearing on the screen was stereotype-consistent (e.g., a photograph of an elderly person and the word 'forgetful'), and to press a 'yes' button when the pair of stimuli on the screen was not stereotypical. As expected, such training reduced subsequent automatic stereotype activation. Therefore, it could be predicted that associating the idea of corpulence to beauty by repeated exposure to specific pairs of stimuli could break the dominant association between thinness and beauty, and possibly attenuate some of the negative consequences of such an association.

Retraining has proven to be efficient in modifying reactions to a number of threatening situations. In the framework of the cognitive bias modification approach (Grafton & MacLeod, 2014), retraining interventions often aimed at altering the association between a given concept and behavioral approach tendencies. Several studies relied on approach bias modification to modulate cigarette smoking, alcohol consumption, unhealthy eating behavior, and implicit evaluation of unhealthy food (Becker et al., 2015; Brockmeyer et al., 2015; Eberl et al., 2013; Fishbach & Shah, 2006; Houben et al., 2012; Kakoschke et al., 2017a, b, c, d; Wiers et al., 2011). Parallel results have also been observed in the field of social psychology, in relation to threatening contexts that impair cognitive performance (Kawakami et al., 2008). More recently, approach/avoidance training has also been tested as a way to improve body image, but the results were mixed, ranging from positive (Kollei et al., 2018) to inconclusive (Glashouwer et al., 2020). To summarize, retraining behavioral approach/avoidance tendencies might be a promising method for protecting individuals from unhealthy thoughts and behaviors, although the efficiency of this technique on body image concerns has yet to be confirmed.

However, evidence suggests that it may not be necessary to retrain action tendencies to change implicit attitudes and behavior. Rather, merely exposing individuals to counter-stereotypic associations may be sufficient in itself (Lai et al., 2016). This approach sometimes relies on evaluative conditioning, shown to be efficient in changing attitudes (for a meta-analysis, see Hofmann et al., 2010, with the exception that the conditioned stimulus is not neutral to begin with). In this vein, recent research has sought to apply evaluative conditioning procedures in order to foster a positive body image among women (Aspen et al., 2015; Glashouwer et al., 2018; Glashouwer et al., 2019; Kosinski, 2019; Martijn et al., 2015; Martijn et al., 2010; Martijn et al., 2013). A number of studies have focused on pairing images of participants' own bodies with positive stimuli. This line of research also resulted in mixed findings. While some studies yielded encouraging results

(Aspen et al., 2015; Martijn et al., 2010), others were less conclusive (Glashouwer et al., 2018; Glashouwer et al., 2019; Kosinski, 2019).

A different approach consisted in attempting to change the representation of the beauty standard. To this aim, Martijn and colleagues (2013, Study 1) trained female participants in the experimental condition to associate photographs of supermodels with 'fake' and photographs of more realistic Dove models with 'natural'. In the control condition, the categories 'fake' and 'natural' were replaced with 'verb' and 'noun', and were thus not valenced. The dependent measure was implicit thin ideal idealization, as assessed by an Implicit Association Test (IAT, Greenwald et al., 2003). The critical associations were 'supermodel + my ambition' and 'Dove model + my lowest standard', tapping the motivational aspect of internalization. The results showed that participants who had learned to associate 'supermodel' with 'fake' and 'Dove model' with 'natural' displayed weaker implicit thin ideal idealization than participants in the control condition. The second study relied on a repeated measure design and an explicit dependent measure. The Body Image States Scale (Cash et al., 2002) was administered before and after a conditioning procedure. In this task, participants had to click as quickly as possible on photographs of curvy models in bathing suits, thin models in bathing suits, or bathing suits only. In the retraining condition, curvy models were always followed by a synonym of 'natural', thin models by a synonym of 'fake', and bathing suits alone by a type of fabric (e.g., 'viscose'). In the control condition, all photographs were followed by a random word from these three categories. The results showed that retraining led to an increase in body satisfaction from pre- to post-test, while no change was observed in the control condition. This research convincingly showed that retraining procedures akin to evaluative conditioning can impact both implicitly measured desire to resemble the thin models and explicit body image. It thus underlines the importance of pursuing this line of research in relation to body image, with the aim of developing efficient protective strategies.

Nevertheless, some ambiguities persist and warrant further examination. First, participants were conditioned to see thin supermodels as 'fake' rather than 'unattractive'. While each of these adjectives is negatively valenced, a model that might be 'fake' might at the same time still be 'attractive'. Therefore, the question remains whether the effects are due to supermodels being cast as irrelevant comparison targets ('she's attractive but she's fake') or as negative role models ('she's fake therefore she's actually not attractive' or 'she's fake therefore I don't want to be like her'). In other words, it is not clear whether the retraining decreased participants' desire to be thin, or increased their motivation to be natural rather than fake. Second, the measure of thin ideal internalization in the first study focused on participants' goals ('my ambition' vs. 'my lowest standard'), rather than the belief that a woman can be curvy and beautiful at the same time. It could thus be argued that this measure captured the implicit desire to be thin, rather than implicit thin ideal internalization. Indeed, it is possible to consider thin supermodels as attractive, but

not want to be like them because they are 'fake'. Martijn et al. (2015) underline themselves that the use of 'fake' and 'natural' adjectives was likely to be 'new and unusual' to participants. Therefore, we sought to bring a further contribution in this line of research by directly focusing on the 'thin-beautiful' versus 'large-beautiful' association and the related 'thin is beautiful' implicit belief (Study 1). In addition, to extend Martijn et al.'s (2013) conclusions, we used a measure of body anxiety specifically focused on the social aspect of physical appearance, that is, the fear of being unfavorably judged by others (Study 2), and an implicit measure of the 'me-beauty' association to assess changes in implicit self-evaluation of physical appearance. Finally, in the retraining procedure we did not rely on photographs, but merely on words, in order to test the assumption that modifying purely semantic associations can also be beneficial, even if pictorial stimuli are not involved. In what follows, we provide a brief overview of the reported studies.

The Present Research

We sought to modify semantic associations between the concept of beauty and the concept of thinness, departing from the more extensively studied approach bias modification procedures, as well as from pictorial stimuli in the retraining procedure as used by Martijn et al. (2013). It was hypothesized that exposing women to different proportions of semantic pairings of words related to corpulence on one side, and words related to beauty on the other side would have beneficial effects for their body image. We assessed the effects of associative retraining on three main outcomes: the implicit belief that thin (but not curvy) women are beautiful (Study 1), as well as implicit associations between self and beauty (i.e., implicit self-evaluation of physical attractiveness) and explicit, conscious feelings of social physique anxiety (Study 2). In so doing, we aimed to extend and complement the findings reported by Martijn et al. (2013), in which a retraining procedure based on the '(pictures of) supermodels – fake' association was used. Also, we focus on current appearance-related outcomes as dependent measures, rather than goal constructs as in Martijn et al. (2013).

If it is true that repeated exposure to extremely thin models presented as beautiful reinforces the belief that to be beautiful a woman has to be thin, then repeated exposure to large-beautiful pairings should attenuate this belief (Hypothesis 1). This hypothesis was tested in the first study. Extending this research to possible downstream effects of modifying the 'thin is beautiful' belief, we then examined the impact of the associative retraining procedure on implicit association between self and beauty and explicit social physique anxiety. Indeed, explicit, conscious affect is quite often a source of considerable psychological pain. Under the assumption that the thinness-beauty association and the related 'thin is beautiful' belief fuel fear about unfavorable evaluations by others, it was predicted that the retraining procedure should strengthen the implicit association between self and beauty (Hypothesis 2), and attenuate explicit social physique anxiety (Hypothesis 3). These hypotheses were tested in the second study.

Study 1

Implicit beliefs can be assessed with the Relational Responding Task (RRT, De Houwer et al., 2015). Although recent, this measure has already been successfully used in body image research (Glashouwer et al., 2018; Heider et al., 2018). For instance, implicit belief that one is thin was negatively related to body dissatisfaction, while implicit desire to be thin was positively related to it (Heider et al., 2018). Similarly, Glashouwer et al. (2018) have further provided evidence that the implicit belief that one is thin is positively associated with a parallel explicit measure, as well as with an explicit measure of the desired body image. These results established the empirical basis for the validity of the RRT procedure in measuring body-related implicit beliefs. Based on this previous research, in the present study we created a RRT to measure implicit thin ideal internalization: the belief that thin but not curvy women are beautiful. It was predicted that repeated exposure to thinness-beauty word pairings would reinforce the association between these two concepts and thus attenuate the implicit belief that only thin women are beautiful. All manipulations and measures are reported in what follows.

Method

Open data and power analysis

The data used in the reported analyses is available here: https://osf.io/hndft/?view_only=5db0f3bd22fe46e0855a447d31170ab7. We conducted prospective power analysis to determine sample size. To achieve 80% power to detect a small-to-medium effect of $d = 0.42$ (mean effect size in social psychology, Richard et al., 2003) with a two-tailed t-test for independent samples ($\alpha = 0.05$), 180 participants are necessary. Therefore, we decided in advance to include 180 participants in our sample.

Participants

One hundred and eighty female university students took part in this study ($M_{age} = 22.26$, $SD = 6.38$). The study was conducted at two sites. One hundred and thirty-four participants were from Paris ($M_{age} = 22.18$, $SD = 7.15$) and 46 were from Poitiers ($M_{age} = 22.50$, $SD = 3.28$). Paris and Poitiers are separated by 295 km (about 183 miles). Most participants were psychology students ($N = 121$). The city in which the experiment was run was included in preliminary analyses, which yielded no significant effects involving this factor. Therefore, the results reported below were collapsed across cities. In each city, participants were randomly assigned to experimental conditions.

Materials

Retraining task

The aim of this task was to reinforce (in the experimental but not in the control condition) mental associations between the concepts of 'large' and 'beautiful'. The task comprised two identical series (or two blocks) of 32 pairs of words. Within each pair, one word designated the body type: either related to being thin (e.g., *petite*, *slim*) or large (e.g., *curvaceous*, *fat*). The other word was always related to beauty (e.g., *sexy*, *beautiful*, *desirable*). The side of the

screen on which body type and beauty words were presented was counterbalanced. In the *retraining condition*, 75% (48 out of 64) of word pairs were 'large-beautiful' pairings and the other 25% were 'thin-beautiful', while in the *control condition* 50% (32 out of 64) were 'large-beautiful' and the other 50% were 'thin-beautiful'. Participants were asked to press 'l' to indicate when a 'large-beautiful' pair appeared and 'd' when a 'thin-beautiful' pair appeared. The side of the pair on which each category of words (i.e., 'thin'/'large' and 'beautiful') appeared was counterbalanced across trials. Each trial was separated by a fixation cross (1000 ms). Once the participant gave her answer, feedback appeared on the screen (correct vs. error). During the second block, presented pairs were identical to the first one, only the response keys were reversed. The task took approximately 5 minutes to complete.

Implicit belief (Relational Responding Task)

The relational responding task (De Houwer et al., 2015) was used to measure implicit beliefs. The logic of this task is that individuals will be slower to categorize as false the statements that they agree with than those that they disagree with. Inversely, they would be slower to categorize as true the statements that they disagree with than those that they agree with. Relational Responding Task requires participants to respond 'true' or 'false' to a number of statements presented successively on the computer screen in line with certain beliefs, independent from their own opinions. This allows for a score of implicit belief to be calculated on the basis of the difference in response latencies for statements reflecting the target belief and response times for statements reflecting the opposite of the target belief.

The version of the RRT used in this study was modeled after the one described by De Houwer et al. (2015). The content of the stimuli was adapted to assess the extent to which participants believed that female beauty is necessarily associated with a slender body. The task comprised five trial blocks. In the *first block*, five synonyms of 'true' (e.g., 'correct', 'accurate') and five synonyms of 'false' (e.g., 'misleading', 'deceitful') were presented four times each (for a total of 40 trials). In each trial, participants had to categorize the displayed word into one of the two categories presented in the upper left ('false') and the upper right corner ('true') of the screen. These categories remained displayed in the same way for all trial blocks. In the *second block*, 10 statements compatible with the 'thin is beautiful' target belief and 10 statements incompatible with this belief (i.e., implying that large is beautiful) were presented twice each (for a total of 40 trials). Participants were instructed to respond in line with the belief that 'thin is beautiful', by categorizing each statement as being true or false, irrespective of their personal opinion. These first two blocks served as training blocks where participants learned to categorize words and statements into 'true' and 'false' categories according to specific instructions. The *third block* was a mixed block, comprising both words from Block 1 (synonyms of 'true' and 'false') and statements from Block 2 (compatible or incompatible with the 'thin is beautiful' target belief), for a total of 80 trials. As participants had

to respond in line with the target belief, this block was labeled *compatible*. Participants had to categorize words and statements according to the same rules as those practiced in Blocks 1 (for words) and 2 (for statements). In the *fourth block*, the same 20 statements as the ones used in Block 2 were displayed twice each, but participants had to respond in line with the belief that 'large is beautiful' (again irrespective of their personal opinion). This block served as a training block for participants to learn to categorize statement in line with the new rule. Finally, the *fifth block* was identical to the third block (80 trials: 10 words presented four times each and 20 statements presented twice each), except that statements had to be categorized in the same way as in Block 4 (in line with the belief that 'large is beautiful'). As participants had to respond in line with a belief contrary to the target belief, this block was labeled *incompatible*. Trial order was random in each block. Response times from the compatible (Block 3) and the incompatible (Block 5) blocks were used in the calculation of the implicit belief score. Importantly, trials in which the target stimulus is a synonym of 'true' or 'false', also referred to as inducer trials, serve to prevent participants from recoding their responses in terms of spatial locations (that is, as requiring left and right key presses, irrespective of instructions to respond in line with a given belief, De Houwer et al., 2015). As participants did not have to enter a correct response after they had made an error, we used the D6 improved algorithm, that includes a penalty of 600 ms for false responses, to calculate the implicit belief score (Greenwald et al., 2003). The effect was scored in such a way that positive scores reflected faster response times in the compatible than in the incompatible block, that is, higher implicit belief that 'thin is beautiful' (see appendix for a complete list of stimuli used in the RRT).

Procedure

Participants were run individually in an experimental room equipped with a computer. They first completed the retraining task and then the RRT. Both tasks were presented as 'categorization tasks'. At the end of the procedure, participants completed a short paper-and-pencil questionnaire with information about their age, curriculum level, major, mother tongue, height and weight, and were debriefed and thanked. The height and weight data were subsequently used to calculate each participant's Body Mass Index (BMI). BMI was calculated to explore its potential role in moderating the effect of retraining.

Results

Descriptive statistics

The average level of BMI in the sample was 21.46 ($SD = 3.22$), ranging from 16.56 to 35.16. BMI was unrelated to the implicit belief that thin is beautiful, $r(179) = -.09$, $p = 0.23$. Overall, participants did not endorse the implicit belief that thin but not curvy women are beautiful ($M = -0.09$, $SD = 0.40$, $CI_{95}[-0.15, -0.03]$), $t(178) = -3.14$, $p = 0.002$ (difference from 0). While 102 participants had an implicit belief score lower than 0, indicating that they did not implicitly endorse the implicit 'thin is beautiful' belief, 77 had scores higher than 0, indi-

cating that they held the implicit 'thin is beautiful' belief. These results seem somewhat surprising, suggesting that this belief may not be largely shared at an implicit level. At the same time, it should be kept in mind that the RRT was administered after the retraining task in both conditions, and that across conditions there were more large-beautiful than thin-beautiful word pairings. In addition, it is possible that explicit measures tend to overestimate thin ideal internalization due to social expectations to endorse thinness as a criterion of female beauty.

Relational responding task

Data were screened for outliers, using the median absolute deviation (MAD) method outlined by Leys et al. (2013), with outlier detection threshold set to 3, as recommended by these authors. There were no outliers on the RRT score according to this criterion. To test our hypothesis, we submitted the implicit belief RRT score (D_{RRT}) to an independent samples t-test with the retraining condition (retraining vs. control) as the independent between-participants factor. This test yielded a significant result, $t(177) = -2.94$, $p = .004$, $d = 0.44$, $CI_{95}[0.14, 0.74]$, showing that participants in the retraining condition had a weaker 'thin is beautiful' implicit belief ($M = -0.18$, $SD = 0.42$, $CI_{95}[-0.27, -0.10]$) than participants in the control condition ($M = -0.01$, $SD = 0.36$, $CI_{95}[-0.09, 0.07]$). Thus, the retraining manipulation changed the implicit beliefs such that a larger proportion of large-beautiful word pairings led to weaker 'thin is beautiful' implicit beliefs, in line with Hypothesis 1 (Figure 1).

Bayesian analysis (Cauchy's prior = 0.707) indicated that the hypothesis that the retraining group had weaker 'thin is beautiful' implicit belief than the control group is approximately 17 times more likely than the null hypothesis, $BF_{10} = 17.04$. According to frequently used guidelines (Jeffreys, 1961), this constitutes strong evidence in favor of the hypothesis.

A complementary regression analysis was run with condition, BMI, and condition by BMI interaction as predictors. In this analysis, condition was coded -0.50 for the retraining and 0.50 for the control condition, and BMI was centered. Condition significantly predicted the RRT score, $B = 0.17$, $SE = 0.059$, $\beta = 0.22$, $t(175) = 2.96$, $p = 0.003$, while neither BMI, $B = -0.01$, $SE = 0.009$, $\beta = -0.10$, $t(175) = -1.32$, $p = 0.19$, nor the interaction term did, $B = -0.008$, $SE = 0.018$, $\beta = -0.03$, $t(175) = -0.46$, $p = 0.65$.

Discussion

The aim of Study 1 was to test whether retraining 'thin-beautiful' semantic associations can influence the degree to which individuals endorse the implicit belief that 'thin is beautiful' (i.e., implicit thin ideal internalization). Results showed that retraining associations attenuated implicit thin ideal internalization. When most of the word pairings that participants were exposed to associated the concepts of 'large' and 'beautiful', the 'thin = beautiful' implicit belief was weaker than when half of the word pairings associated 'large' and 'beautiful'. In fact, when 'thin-beautiful' and 'large-beautiful' pairings were presented equally frequently (i.e., in the control condition), the implicit belief

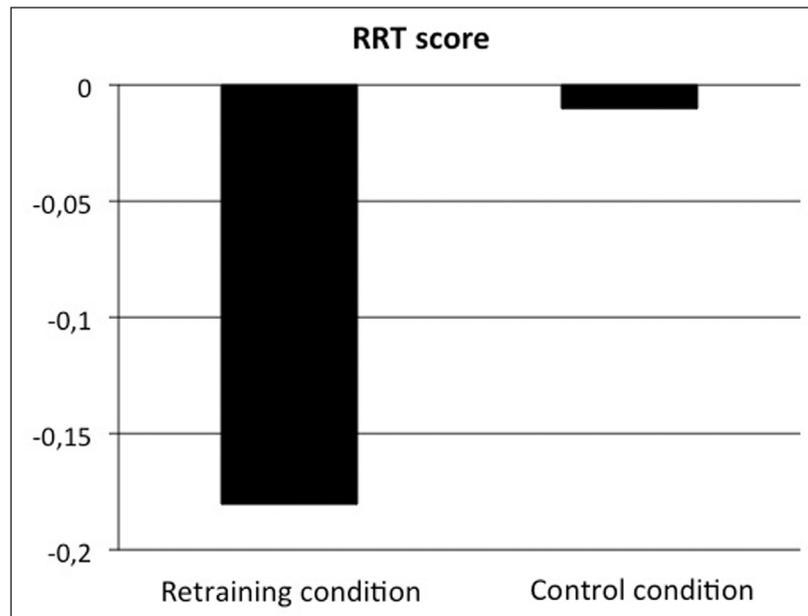


Figure 1: Mean scores on the Relational Responding Task as a function of experimental condition.

measure was very close to 0, suggesting that participants in this condition endorsed neither belief. These findings are consistent with the idea that (implicit) beliefs can be modified by mere exposure to semantic pairings. The next study aimed to test whether retraining the ‘thin–beautiful’ associations, now known to change the implicit ‘thin is beautiful’ belief, can also influence implicit self-evaluation of attractiveness and explicit social physique anxiety. After the retraining procedure, a single-category Implicit Association Test was used to examine whether retraining thin-beautiful associations impacts the strength of the me-beautiful association, that is, implicit self-evaluation of beauty. Then, participants completed an explicit measure of social physique anxiety to test whether retraining can change consciously felt anxiety about one’s physique being evaluated by others. All manipulations and measures are reported in what follows.

Study 2

Method

Open data and power analysis

The data are publicly available on the Open Science Framework page: <https://osf.io/hndft/>. The power analysis reported for Study 1 is also valid for Study 2.

Participants

Two samples of female participants were recruited for a study on body image. Each sample consisted of undergraduates from two different French Universities, one in Paris and the other one in Poitiers. The first sample was composed of 97 students ($M_{age} = 18.83$, $SD = 1.52$) and the second one of 98 students ($M_{age} = 21.79$, $SD = 6.28$), for a total of 195. The analyses reported below were first run with city as an additional factor. The city factor did not qualify the effect of the retraining condition on the dependent variables. Thus, the two samples were combined. In each city, participants were randomly assigned to experimental conditions.

Materials and procedure

The experimenter first outlined the upcoming tasks and told the participants to follow the instructions on the screen. Participants then provided written consent for their participation and demographic information. The different tasks were completed by the participants in the order in which they are described below.

Body dissatisfaction

Previous research has documented high self-reported body dissatisfaction as a factor of vulnerability to effects of exposure to the thin ideal in several meta-analytic studies (Ferguson, 2013; Grabe et al., 2008; Groesz et al., 2002; Want, 2009) and as associated with high internalization of the thin ideal (e.g., Fitzsimmons-Craft et al., 2012; Vartanian & Dey, 2013). Therefore, this construct was assessed as a potential moderator. Participants began by completing the nine items of the Body Dissatisfaction Subscale ($\alpha = 0.85$) of the Eating Disorder Inventory (Garner et al., 1983). Responses were given on scales ranging from 1 (Completely disagree) to 7 (Completely agree). This measure was included to test whether individual differences in body dissatisfaction moderate the effects of retraining on our dependent variables.

Retraining task

This task was identical to the one used in Study 1. Participants were randomly assigned to one of the two retraining conditions (75% vs. 50% of large-beautiful pairings).

Single-Category Implicit Association Test (SC-IAT)

This task aimed to measure the strength with which participants associate their own self with the idea of beauty. We used the single-category version because we were only interested in implicit self-evaluation of beauty (Karpinski & Steinman, 2006). The test consisted of three blocks of trials. In the first block, participants had to categorize words appearing in the center of the screen into one of

two categories: 'pretty' and 'ugly'. There were two words related to each of these categories, and each was presented twice. This was a short training block. The order of the second and the third block was randomized – these were the compatible and the incompatible block. In the compatible block, two words related to the self were added as targets ('I' and 'me') in addition to synonyms of 'pretty' and 'ugly'. Self- and beauty-related word shared the same response key. Each target word was presented three times. The incompatible block was similar, except that self- and ugliness-related words shared the same response key. A score was calculated on the basis of the difference in mean response times between the compatible and the incompatible trial blocks, such that higher scores indicated stronger implicit association between 'me' and 'pretty' (the D6 algorithm was used to calculate the score, Greenwald et al., 2003).

Social physique anxiety

Finally, participants completed the 12 items of the Social Physique Anxiety Scale ($\alpha = 0.90$, Hart et al., 1989, sample item: 'I wish I wasn't so uptight about my physique or figure.'). Responses were given on scales ranging from 1 (Completely disagree) to 7 (Completely agree). We included this scale to test if the effect of retraining observed on implicit beliefs also extends to feelings about how one's appearance is being judged by others. It was shown to be related to a negative body image, as well as to a risk of developing eating disorders in young girls (Diehl et al., 1998; Diehl et al., 2002; Thompson & Chad, 2002). At the end, participants were debriefed and thanked for their participation.

Results

Descriptive statistics

Overall, participants significantly associated the self with the idea of beauty ($M = 0.19$, $SD = 0.47$, $CI_{95\%}[0.12, 0.26]$), $t(191) = 5.63$, $p < 0.001$ (difference from 0). In addition, they were moderately anxious about their physical appearance ($M = 4.29$, $SD = 1.30$, $CI_{95\%}[4.10, 4.48]$), $t(191) = 3.12$, $p = 0.002$ (difference from 4, the midpoint of the scale). These two variables were weakly but significantly negatively correlated, $r(192) = -0.14$, $p = 0.047$.

Preliminary analysis

To explore potential preexisting differences in body image between experimental conditions, we conducted a one-way ANOVA with retraining as the independent factor and body dissatisfaction as the dependent measure. This analysis yielded a non significant result, $F(1, 190) = 1.47$, $p = 0.23$, $\eta^2_p = 0.008$. Thus, no evidence was found for preexisting differences in body image, at least as indicated by body dissatisfaction level.

Implicit association between self and beauty

Using the same method and criterion for outlier detection as in Study 1, none were detected in the SC-IAT score. The SC-IAT scores were submitted to an independent samples t-test with the retraining condition (retraining vs. control) as the independent between-participants

factor. Participants in the retraining condition ($M = 0.17$, $SD = 0.49$, $CI_{95\%}[0.08, 0.27]$) did not significantly differ from participants in the control condition ($M = 0.21$, $SD = 0.45$, $CI_{95\%}[0.11, 0.31]$), $t(190) = 0.54$, $p = 0.59$, $d = 0.08$, $CI_{95\%}[-0.21, 0.36]$. Therefore, retraining did not impact the self-beauty association, failing to corroborate Hypothesis 2. Bayesian analysis (Cauchy's prior = 0.707) indicated that the null hypothesis of no difference is more than five times more probable than the alternative hypothesis, $BF_{01} = 5.60$. This constitutes evidence in favor of the null hypothesis (Jeffreys, 1961).

A complementary regression analyses was run with condition, body dissatisfaction, and condition by body dissatisfaction interaction as predictors. In this analysis, condition was coded 0.50 for the retraining and -0.50 for the control condition, and body dissatisfaction was centered. None of the predictors had a significant effect: $B = -0.43$, $SE = 0.068$, $\beta = -0.46$, $t(188) = -0.63$, $p = 0.53$ for condition, $B = -0.03$, $SE = 0.028$, $\beta = -0.08$, $t(188) = -1.08$, $p = 0.28$ for body dissatisfaction, and $B = -0.004$, $SE = 0.055$, $\beta = -0.005$, $t(188) = -0.06$, $p = 0.95$ for the interaction term.

Social physique anxiety

Once again, data were first screened for outliers and none were detected, according to the same criteria as for the RRT and the SC-IAT scores. The Social Physique Anxiety Scale scores were submitted to an independent samples t-test with the retraining condition (retraining vs. control) as the independent between-participants factor. This test yielded a significant result, $t(190) = 2.39$, $p = .018$, $d = 0.35$, $CI_{95\%}[0.06, 0.63]$, showing that participants in the retraining condition had less body anxiety ($M = 4.08$, $SD = 1.41$, $CI_{95\%}[3.82, 4.33]$) than participants in the control condition ($M = 4.52$, $SD = 1.14$, $CI_{95\%}[4.26, 4.78]$). Thus, retraining was efficient in attenuating social physique anxiety, as predicted by Hypothesis 3 (**Figure 2**).

Bayesian analysis (Cauchy's prior = 0.707) indicated that the hypothesis that the retraining group had less body anxiety than the control group is approximately four times more likely than the null hypothesis, $BF_{10} = 4.40$. This provides substantial evidence in favor of the hypothesis (Jeffreys, 1961).

A complementary regression analysis was run with condition, body dissatisfaction, and condition by body dissatisfaction interaction as predictors. In this analysis, condition was coded -0.50 for the retraining and 0.50 for the control condition, and body dissatisfaction was centered. Condition significantly predicted body anxiety score, $B = 0.28$, $SE = 0.13$, $\beta = 0.11$, $t(188) = 2.18$, $p = 0.031$. Unsurprisingly, so did body dissatisfaction, $B = 0.73$, $SE = 0.05$, $\beta = 0.71$, $t(188) = 13.92$, $p < 0.001$. However, the interaction term was not significant, $B = -0.06$, $SE = 0.11$, $\beta = -0.03$, $t(188) = -0.61$, $p = 0.54$.

Discussion

We reasoned that if the association between thinness and beauty is one of the causes of social physique anxiety, then weakening this association by a retraining procedure should strengthen the implicit self-evaluation of appearance and attenuate social physique anxiety. The results

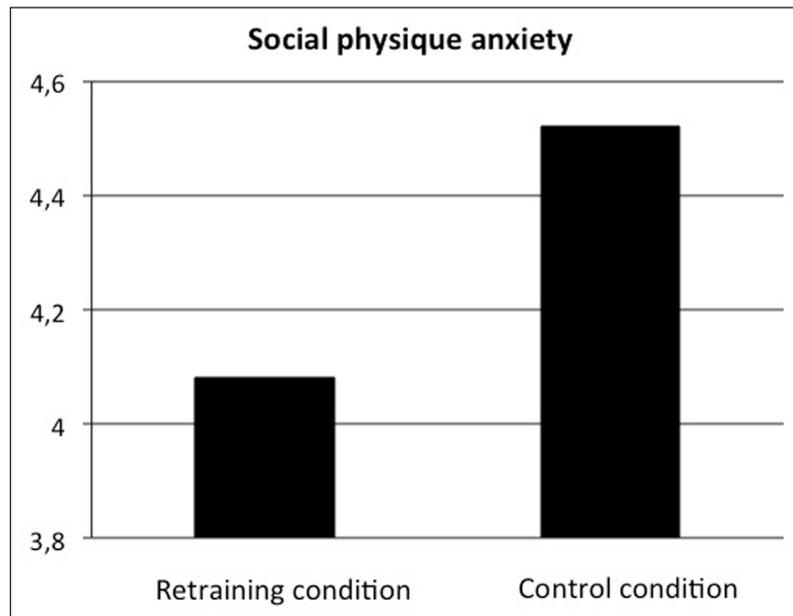


Figure 2: Mean scores on the Social physique anxiety scale as a function of experimental condition.

were partially consistent with this prediction. Contrary to predictions, the implicit self-evaluation of appearance was not affected by the retraining intervention, suggesting that weakening the association between beauty and thinness did not foster a more positive implicit body image.

However, explicit anxiety about physical appearance was decreased by the retraining intervention. This finding thus shows that associating thinness with beauty, and possibly holding the belief that it is necessary to be thin in order to be beautiful, as Study 1 suggests, plays an important role in fostering social anxiety about one's physical appearance among women. In addition, this effect was not moderated by body dissatisfaction level. This suggests that even women who are relatively unsatisfied with their appearance can potentially benefit from retraining in order not to be anxious about it. The absence of effect on implicit self-evaluation of appearance can be accounted for in several ways. First, it is possible that the single-category IAT measure was not sensitive enough to capture the effect. Indeed, a more complete and longer, traditional IAT was more widely used in previous research, and therefore represent more reliable tools. A second possibility is that the effect was too small to be detected in a sample of 195 participants, or that even if power was appropriate, we are facing a type II error that remains possible in 20% of cases if power is 0.80. Third, an important difference between the two measures is also their self-reported versus indirect nature. Only the self-reported measure was affected by the retraining manipulation. It is thus possible that the large-beautiful associative training that was used in this research affects the extent to which participants endorse the standard and think that they will be judged according to the standard, but that their deeply held and automatic self-evaluation of appearance remains unaffected. Finally, it is possible that implicit self-evaluation of appearance was not affected by retraining, which raises interesting questions with regard to the positive findings on the appearance anxiety scale. Given the social focus of

the appearance anxiety scale that was used, the different pattern of results on implicit self-evaluation and appearance anxiety may suggest that women are anxious not so much about how beautiful they are (in their own eyes), but rather about how other people judge their appearance.

All of these explanations remain highly speculative, and it remains to be verified if this absence of effect is in fact reliable.

General Discussion

In the present research, we sought to examine the causal role of semantic associations involving thinness and beauty in implicit beliefs about thinness as a criterion for female beauty, implicit self-evaluation of beauty, and self-reported social physique anxiety. To the best of our knowledge, this is the first study to directly address these questions. Consistent with predictions, weakening thin-beautiful (and reinforcing large-beautiful) semantic associations attenuated the implicit belief that only thin women are beautiful and appearance-related social anxiety. However, it did not increase the implicit association of self and beauty, as assessed by a single-category IAT. If implicit self-evaluation of appearance is indeed unaffected by retraining the thin-beautiful associations, this may suggest that the association between thinness and beauty is not strongly related to implicit self-evaluation of appearance. Indeed, to influence implicit self-evaluation of appearance, targeting the 'me-beauty' associations in a retraining intervention is likely to be more efficient. Taken together, the present findings suggest that it might be interesting for future research to differentiate the feelings that women may have in relation to how their appearance is evaluated by others from the way that they evaluate their own appearance themselves.

This work also complements the conclusions of Martijn et al. (2013) in several ways. First, it shows that merely modifying semantic associations between concepts can have beneficial effects, even if no photographs are used

in the procedure. This is quite useful to know, because it demonstrates that it is not necessary to expose young women to thin ideal pictures in order to build an efficient intervention. Second, the present work was directly focused on the thinness-beauty association, pinpointing the role of thinness as a criterion for female beauty, rather than on the idea that top models are 'fake', which does not exclude the possibility that they can still be perceived as attractive. Finally, our work extends Martijn et al.'s by showing promising effects on different dependent measures, namely implicit belief that thin but not voluptuous women are attractive and the anxiety related to one's attractiveness being evaluated by others.

Theoretical Implications

Our findings corroborate the idea that the strength of the thin-beautiful semantic association affects the corresponding belief that 'thin is beautiful' (Study 1), and that this association plays an important role in fostering appearance-related social anxiety (Study 2). Taken together, these results are consistent with previous research and theorizing on thin internal idealization, to the extent that the implicit 'thin is beautiful' belief is, as we suggest, a way to conceptualize implicit thin ideal internalization. Ample research has demonstrated the implication of self-reported thin ideal internalization, as assessed most frequently by the Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ, Schaefer et al., 2015; Thompson et al., 2004), in adverse psychological outcomes related to body image. For instance, this construct has appeared prominently as a moderator of reactions to thin ideal exposure and as a vulnerability factor among women who strongly internalize the thin ideal as a standard of beauty (Brown & Dittmar, 2005; Dittmar et al., 2009; Dittmar & Howard, 2004; Thompson & Stice, 2001). In addition, it has been argued that sociocultural pressures to be thin, as exemplified in the ubiquitous thin ideal images and other media content, pave the way for women to internalize thinness as a criterion of female beauty (e.g., Polivy & Herman, 2004; Thompson & Stice, 2001). It has been shown, for example, that even among girls as young as 9 to 12 years old, awareness of the cultural ideal of thinness is positively associated with thin ideal internalization (Sands & Wardle, 2003). We contribute to this line of research by conceptualizing the construct of thin ideal internalization on the basis of an implicit measure: the relational responding task (Heider et al., 2015). Importantly, as recently recommended by Heider et al. (2018), we have shown a way to modify implicit beliefs. Also, it is worth emphasizing that consistent results were observed across two studies, on both implicit and explicit dependent measures. Thus, retraining does not only affect the implicit beliefs likely to underlie and foster negative body image, but also explicit subjective feelings of anxiety about one's appearance being evaluated by others.

In this vein, and as argued in the introduction, these findings can be taken as evidence that the frequency of co-occurrence of a pair of semantic stimuli plays a causal role in shaping more complex cognitions such as beliefs, as well as emotional states related to how one thinks that

other might see them. In relation to this, there is a lively debate in the literature about whether associative processes should be distinguished from propositional ones, and if there is a difference, whether it is qualitative or one of degree. Although this question is not at the heart of the present inquiry, the fact that pattern activation (frequency of co-occurrence) impacts beliefs (propositions with truth value) are in line with the idea that what is labeled by some authors as associative and propositional processes (e.g., Gawronski & Bodenhausen, 2006) share common features (Kruglanski & Dechesne, 2006).

In addition, while the importance of thin ideal internalization (self-reported belief that this is beautiful) has already been extensively studied, indirect procedures such as associative retraining and measures of implicit cognition have comparatively rarely been used in this line of research. Also, we know of no other empirical work that has endeavored to improve, at least momentarily, women's psychological well-being by directly acting on the strength of this semantic association, or that has tested the causal nature of the relationship between the thin-beautiful association and relevant outcomes by modifying the associative links. Thus, the present work brings both theoretical and methodological innovations to the field of study of body image.

Applications

On the applied side, these findings open a new avenue for research on ways to protect vulnerable populations from detrimental effects of thin ideal exposure. Women who complete a retraining procedure may react less negatively to thin ideal exposure than those who do not undergo such training. More specifically, increase in body dissatisfaction usually observed after thin ideal exposure might be attenuated or suppressed by previously retraining mental associations between thinness and beauty. The results reported here can be related to the idea that specific beliefs can moderate the impact of social comparison (Butler, 2000; Kruglanski & Maysel, 1990). To the extent that appearance comparison focused on thinness is responsible for the negative effects of thin ideal exposure, weakening the 'thin is beautiful' belief (the specific content of the comparison) could impact the reactions to thin ideal exposure. In other words, the subjective meaning of the exact same comparison would not be the same as a function of the retraining procedure. This is an interesting avenue for future research in the domain of body image concerns.

Of course, future research should endeavor to determine the extent of retraining needed to obtain a stable protective effect, and the efficiency of such interventions (or more intense programs based on the same principle) in the long-term. In line with Wiers et al.'s (2011) findings, a brief treatment of several sessions could potentially have a long-lasting effect (see also and Aspen et al., 2015; Eberl et al., 2013; Tello et al., 2018). Naturally, the present results are relevant in clinical and psychological counseling settings. Retraining associations would be easy to implement: within a counseling/therapy session, one retraining task would not take more than a few minutes

and could be targeted to those who most need it. It would even be possible to implement retraining in the context of a smartphone application or a serious game (see for example Kollei et al., 2017). However, more research is warranted before the present findings can be practically implemented. In particular, it should be ascertained not only that the retraining procedure can produce some relatively long-term benefits, but also that it is not counter-indicated in specific populations (e.g., very thin women). Alternatively, groups that may be exposed to undesirable effects related to the retraining procedure should be identified, in order for them not to be exposed to this technique.

Limitations and Future Research

It could be argued that the control conditions in the reported studies do not reflect what would be status quo – the absence of retraining. Indeed, in everyday life women are likely to be exposed to a much more overwhelming proportion of thin-beautiful rather than large-beautiful pairings than they were in our 50–50 control condition. This might explain the fact that overall, participants did not adhere to the ‘thin is beautiful’ implicit belief, that seems surprising at the first glance. However, this was not a baseline measure, and it should be kept in mind that RRT was presented *after* the retraining phase. In other words, if a baseline implicit ‘thin is beautiful’ belief were measured (prior to any retraining), the average score would probably be positive and different from zero, reflecting a certain level of endorsement. This means that associations may have been ‘retrained’ even in the control condition, but to a lesser extent than in the 75–25 condition. However, had we used a no retraining condition that was more ecological, say 75% of thin-beautiful pairings, our effects would likely have been even stronger. Future research might integrate a no-retraining (baseline) control condition, and/or a 25–75 control condition, to verify this assumption.

If the baseline RRT score (i.e., a score obtained in the absence or prior to any treatment such as associative retraining) relative to the implicit ‘thin is beautiful’ belief is also close to zero or negative, this might suggest that thin ideal internalization is overstated in self-reported measures. Indeed, it has become socially desirable over the years for women to express discontent with their weight and to value the thin ideal as the standard of female beauty (Grogan, 2006; Rodin et al., 1984). Therefore, social conformity might inflate self-reports of thin ideal internalization, while an indirect measure of a parallel construct such as the implicit ‘thin is beautiful’ belief is likely to remain unaffected by social desirability. This could account for an apparently weak implicit belief that women have to be thin to be beautiful. Future research should endeavor to collect data about baseline levels of this implicit belief. Of course, if it turns out that there is overall no implicit endorsement of the thin ideal as the standard of beauty, this would temper the necessity to modify such a belief, and to further develop possible applications of the present research.

Another question for future research is what is the process underlying the link between frequency of co-occurrence and the belief relating thinness to beauty on one hand, and the apprehension of one’s physical appearance

being judged negatively. Going back to research on associative retraining aimed at modifying stereotype activation, Kawakami et al. (2000) suggested three possible mechanisms likely to account for their findings. The first one is motivational: participants may become motivated to negate the stereotype after being trained to do so. This account is not relevant to the present studies, because participants were not asked to negate the association in the retraining procedure. The other two explanations focus on either the reinforcement of non-stereotypical associations or weakening the stereotypical associations. In the present study, it is impossible to disentangle the relative contribution of these two processes, because in the retraining task the frequency of word pairs associating thinness and beauty was interdependent with the frequency of word pairs associating corpulence to beauty, thus both were manipulated simultaneously. However, Gawronski et al. (2008) reported two studies on retraining stereotypic association that aimed precisely to test the idea that it is mainly the reinforcement of non-stereotypical or counter-stereotypical associations that play a key role in deflating automatic stereotype activation. Their results are consistent with this idea, suggesting that in the present research, reinforcing the large-beautiful association might be more important than weakening the thin-beautiful association. Future research could directly test this idea by independently manipulating the reinforcement versus weakening of specific associations.

The results of the two studies reported here suggest that the effect of retraining on body anxiety might be mediated by implicit beliefs about female beauty as being defined by thinness. To provide convincing evidence for such a mediation pattern, a positive relation between implicit beliefs about female beauty and body anxiety would have to be demonstrated. To the best of our knowledge, such data is not available to date. However, Heider et al. (2018) did reliably show that implicit beliefs about being overweight are positively related to self-reported body dissatisfaction. On these grounds, it is highly likely that implicit beliefs about thinness being a criterion of female beauty are related to self-reported body anxiety. This specific hypothesis, however, remains to be tested.

It has been argued that manipulating the mediator is the most desirable practice in testing mediation, because it allows random assignment of participants to mediator levels, contrary to the classical approach in which all three components of mediation are included in the same design and the link between the mediator and the dependent variable is correlational (MacKinnon & Pirlott, 2015; Spencer et al., 2005). Thus, future research could manipulate implicit beliefs to examine their impact on reaction to thin ideal exposure. However, we would like to underline the difficulty of doing this with non-explicit manipulations (such as persuasive techniques for example), because manipulating implicit beliefs would inevitably amount to procedures similar to retraining, which was in fact used here.

Summary and Conclusion

In a social context in which weight is stigmatized, thinness is glorified, and the thin ideal is ubiquitous in media and advertisement, women have come to believe that their

attractiveness depends in great part on their thinness. The present research has shown that retraining the thin-beautiful semantic associations can attenuate such a belief, as implicitly assessed, as well as explicit appearance-related anxiety. Results are consistent with the idea the semantic association between beauty and thinness indeed underlies implicit thin ideal internalization and appearance-related social anxiety. They corroborate the idea that the frequency of exposure to 'thin-beautiful' stimuli pairings is a decisive factor in producing negative outcomes on women's psychological well-being. Therefore, in the long term, efforts should be made on the societal level in order to cease stigmatizing weight and to promote the use of more realistic advertising images, in order to definitely break the thin-beautiful association.

Additional File

The additional file for this article can be found as follows:

- **Appendix.** Stimuli used in the Relational Responding Task (original French versions are in brackets). DOI: <https://doi.org/10.5334/irsp.442.s1>

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Competing Interests

The authors have no competing interests to declare.

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