**The Somatomorphic Matrix-Female:
More Evidence for the Validity of Bidimensional Figural Rating Scales for Women**

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Abstract

Our study aimed to develop and provide a preliminary psychometric validation of the Somatomorphic Matrix-Female (SM-F), a new bidimensional female figural rating scale which can be used to gauge *actual* and *desired* levels of both body fat and muscularity in a consolidated measure, as well as providing an index of actual–desired body discrepancy based on these measures. Across two studies undergraduate women ($n^{\text{Study 1}} = 481$; $n^{\text{Study 2}} = 391$) completed the Eating Disorder Examination-Questionnaire, the Body Shape Questionnaire-34, and the Depression Anxiety Stress Scales-21 (Study 1) and the Drive for Thinness Scale and the Drive for Muscularity Scale (Study 2), as well as the SM-F. Overall, the SM-F demonstrated sound content, concurrent, and convergent validity for actual and desired body fat, actual and desired muscularity, and their respective discrepancy scores.

1 Body dissatisfaction continues to be a pervasive issue in Western nations. Conceptualized as a
2 negative subjective appraisal of one's body and its features (Grogan, 2016), body dissatisfaction
3 is prevalent across a variety of both male and female populations (del Mar Bibiloni et al., 2017;
4 Fiske et al., 2014; Murray et al., 2017; Neighbors & Sobal, 2007), even to the extent that it is
5 considered 'normative' by some researchers (Griffiths et al., 2016; Mond et al., 2013). However,
6 labeling body dissatisfaction as 'normative' does not mean it should be considered to confer no
7 or little harm. In fact, body dissatisfaction has been consistently associated with a multitude of
8 psychopathologies including disordered eating behaviors (Gerner & Wilson, 2005; Grilo et al.,
9 2001; Mayo & George, 2014), body dysmorphic disorder (Veale, 2004), and mood disorders
10 such as depression (Brausch & Gutierrez, 2009; McCreary & Sasse, 2000; Presnell et al., 2004).

11 Given the important role of body dissatisfaction in a variety of psychopathologies, it is
12 critical for researchers and clinicians to have access to tools that accurately and fully capture this
13 construct. However, for a variety of reasons (discussed below), researchers and clinicians have
14 found benefit utilizing brief measures that are proxies for body dissatisfaction.

15 Figural rating scales can be used to indirectly index body dissatisfaction. Typically, these
16 scales present a series of frontal view images of human bodies arranged from thin to obese
17 and/or from lean to muscular. Participants use these scales to select which body (or which point
18 on the scale) represents (a) their current body (i.e., their *actual* body), and (b) their ideal body
19 (i.e., their *desired* body; Talbot et al., 2019). These selections are quantified by where they fall on
20 the scale (from smallest to largest body), and a discrepancy score can be computed by
21 subtracting the *desired* score from the *actual* score where resultant positive values are indicative
22 of being larger (e.g., with a higher level of body adiposity or musculature) than one desires to be.
23 This discrepancy score serves as an important indicator of problematic body image across a

variety of domains. For instance, a large discrepancy between one's desired and actual body is associated with elevated body dissatisfaction (Fingeret et al., 2004; Gardner & Brown, 2010; Talbot et al., 2019; Talbot et al., 2020), reduced body appreciation (Mutale et al., 2016; Novella et al., 2015; Swami et al., 2008), a higher drive for muscularity (Gillen & Markey, 2015; Hildebrandt et al., 2004; Novella et al., 2015), and exacerbated eating disorder symptoms (Smith et al., 2011). It is clear that figural rating scales have the potential to provide a nuanced understanding and assessment of how the pursuit of distinct idealized body types and features connect to eating and weight-related psychopathologies.

Figural rating scales have several notable advantages compared to other traditional self-report proxies for body dissatisfaction. First, they are not dependent on language or literacy skills, therefore lending themselves more readily to use in cross-cultural settings, as well as potentially avoiding psychometric and translational considerations faced by other self-report measures reliant on text comprehension. Second, they provide us with a greater visual understanding of the actual and desired body types, which are unable to be easily gleaned from conventional text-based measures. This information can help provide a snapshot of the variety of body types that individuals select as their "desired" body type, allowing us to compare these ideals across different populations of interest and monitor how these ideals might evolve over time. Relatedly, figural rating scales are applicable regardless of the culturally-specific body ideals in a given context enabling meaningful cross-cultural comparisons of ratings. Third, they allow for time efficient administration (usually less than 30 seconds). With these benefits in mind, the development of accurate figural rating scales that capture core components of body image represents a key endeavor for researchers and clinicians alike.

Existing Figural Rating Scales. Attitudes and feelings towards one's level of body fat and muscularity have been long regarded as integral facets of body dissatisfaction (Grogan, 2016). However, these aspects of appearance have been typically valued in distinct ways across the sexes. For instance, males typically revere increasingly muscular physiques, with voluminous upper-body muscularity and little/no body adiposity so that one's musculature development is prominently displayed (Ridgeway & Tylka, 2005). Unsurprisingly, a preponderance of scientific work on male body dissatisfaction has focused on muscularity (Eik-Nes et al., 2018; McLean et al., 2018; Pope et al., 2016). Accordingly, the development of male figural rating scales has been geared to capture differential preferences in musculature development and related concerns. These scales have been predominantly unidimensional; that is, they measure actual and idealized levels of body fat and muscle mass on separate scales (e.g., The Muscle and Fat Silhouette Measure; Frederick et al., 2007; Male Fit Body Scale; Ralph-Nearman & Filik, 2018). An inherent limitation of such scales is that discrepancies in body fat and muscle mass are unlikely to be mutually exclusive – many males report wanting *lean* muscularity, characterized by high muscularity *in conjunction with* low body fat. Therefore, a key implication of utilizing such unidimensional scales is that researchers are unable to glean an accurate and realistic representation of the idealized body types most endorsed by men. Bidimensional matrices of bodies – where variations of body fat and muscle mass are represented concurrently and are captured on a consolidated scale – overcome this measurement limitation (e.g., The New Somatomorphic Matrix – Male; Talbot et al., 2019; The Body Builder Image Grid; Hildebrandt et al., 2004).

Historically, muscularity has been largely overlooked among female figural rating scales. To date, these scales have typically been unidimensional, presenting only variations in body fat

(e.g., the Photographic Figure Rating Scale; Swami et al., 2008; Figure Rating Scale; Cass et al., 2020). Given that the body ideal for women has focused primarily on thinness in the past several decades, we acknowledge the empirical and clinical utility of such scales. More recently, however, muscularity, particularly toned and lean muscularity, has become a core component of the ideal female physique (variously described as fit or athletic-looking) in Western industrialized countries (Bozsik et al., 2018; Rodgers et al., 2018). Indeed, women with physiques characterized by toned muscularity are often rated as more attractive than those characterized solely by thinness (Bozsik et al., 2018), and recent national surveys in the US suggest significant proportions of women are discontent with their muscle tone/size (e.g., Frederick et al., 2020). Moreover, the swift and global growth in popularity of the *#fitspiration* (i.e., a blend of the terms “fitness” and “inspiration”) movement on social media further attests to the fit, athletic, and toned body types desired by many women. Akin to the drive for thinness, burgeoning research illustrates the links between the drive to improve muscle tone and various psychopathologies in women, including symptoms of disordered eating, depression, and stress (Cunningham et al., 2019; Rodgers et al., 2018).

The recent intensification of the pursuit of toned muscularity among women necessitates the adaptation of figural rating scales to adequately capture this pursuit. The Presentation of Images on a Continuum Scale (PICS; Novella et al., 2015) is a unidimensional female-oriented scale comprising two separate continua of figural bodies from excessively thin to obese, and from excessively thin to highly muscular, ostensibly to index body fat and muscularity, respectively. However, as highlighted earlier, the use of two independent scales to measure body fat and muscle mass is problematic. This approach is particularly important for women, many of whom strive for toned muscularity (i.e., lower body fat in combination with higher muscle) as

opposed to increasing muscle bulk or size, which may be of more importance among men (Choi, 2000; Rodgers et al., 2018). To provide a fine-grained assessment of this emerging appearance ideal among women, it is critical for new self-report tools to be developed to adequately index the pursuit of toned muscularity. Recently, Steinfeld et al. (2020) developed and validated the Body Image Matrix of Thinness and Muscularity - Female Bodies (BIMTM-FB). The BIMTM-FB presents as the first bi-dimensional female rating scale to incorporate both dimensions of body fat and muscularity. The BIMTM-FB was developed concurrently and independently of the Somatomorphic Matrix-Female (SM-F) - a new alternate bi-dimensional female figural rating scale that the present paper seeks to validate. As both figural rating scales were developed around the same time, we were unable to provide a direct comparison of the psychometric validation of the two scales. However, through examining the validation of the SM-F, we were able to extend the psychometric evidence for the utility of bi-dimensional rating female rating scales in general. Notably, we have extended the psychometric evidence by (1) examining concurrent validity through a direct self-report measure of body dissatisfaction (i.e., the Body Shape Questionnaire; BSQ; Cooper et al., 1987), as well as providing further evidence for the relationship between bi-dimensional female figural rating scores and drive for thinness and muscularity, (2) utilizing the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994) as an additional measure of concurrent validity in a non-clinical sample, (3) calculating and examining the validity of actual-desired body discrepancy scores for body fat and muscularity, (4) utilizing two large samples Australian undergraduate women, (5) administering the figural rating scale online via smart devices with touch screen capability, and (6) including occluded faces as opposed to removing heads from figures. Notably, this last point may be important in understanding the best approach to designing figural rating scales. Some studies suggest that there may be significant

differences in visual processing of bodies without heads, compared to bodies with heads or a substitute head-like feature (i.e., processing headless bodies according to their features rather than as a configural whole; Robbins & Coltheart, 2012; Soria Bauser & Suchan, 2018). Further, bodies with a head or head substitute are arguably more ecologically valid compared to headless bodies.

Two studies have been reported in the present paper. Study 1 aimed to establish initial validity evidence for the SM-F tested within a Western society, and Study 2 aimed to extend this validity evidence through examination of drive for muscularity and thinness.

Study 1

The SM-F is a bidimensional female figural rating scale which can be used to gauge *actual* and *desired* levels of both body fat and muscularity with the same measure. In providing a preliminary validation of the SM-F, we hypothesized the following:

H1: As an indicator of content validity, we hypothesized that participants' *desired* body fat would be lower than their *actual* body fat, and their *desired* muscularity would be greater than their *actual* muscularity.

H2: As an indicator of convergent validity, we hypothesized that *actual* body fat and muscularity ratings would be positively correlated with self-reported body mass index (BMI).

H3: As an indicator of concurrent validity, we hypothesized that (a) women who rate their *actual* level of body fat as greater than their *desired* level (as evidenced through a positive discrepancy score¹), and (b) women who rate their *actual* level of muscularity as less than their

¹ Discrepancy scores for body fat are calculated by *actual* – *desired*, where a positive discrepancy score suggests the participant currently has a higher level of body fat than they wish to have.

desired level (as evidenced through a positive discrepancy score²), would report higher body dissatisfaction on the BSQ-34 compared to those who have a lesser difference between their *actual* and *desired* levels of body fat and muscularity, respectively.

H4: As a further indicator of concurrent validity, we hypothesized that (a) women who rate their *actual* level of body fat as greater than their *desired* level, and (b) women who rate their *actual* level of muscularity as less than their *desired* level, would report higher body dissatisfaction on the body shape and body weight subscales of the EDE-Q. Additionally, it is hypothesized that the restraint and eating concern subscales would correlate in an analogous way.

H5: As an indicator of discriminant validity, we hypothesized that there would be a stronger correlation between discrepancy scores and BSQ scores of body dissatisfaction (a construct that is theoretically closely related to actual-desired discrepancy), compared to correlations between discrepancy scores and measures of depression, anxiety, and stress (constructs of lower theoretical relatedness).

Method

Participants

Participants were 481 female undergraduate students (pre-screened for sex) from a large public Australian university who participated for course credit. Participants were aged between 17 and 49 years ($M = 20.92$, $SD = 4.70$), with most born in Australia (74.0%) and predominantly identified as heterosexual (85.2%). Participants reported their ethnicity as Caucasian (48%), Middle Eastern (17%), South Asian (11%), East Asian (9%), African (3%), and other (12%).

² Discrepancy scores for muscularity are calculated by *desired* – *actual*, where a positive discrepancy score suggests the participant currently has a lower level of muscularity than they wish to have.

Participants reported on their weight and height, which was used to calculate body mass index (BMI; kg / m^2), with a mean BMI of 25.08 ($SD = 5.72$; $range = 16.02 - 46.88$).

Measures

Somatomorphic Matrix-Female. The Somatomorphic Matrix-Female (SM-F; Figure 1) was developed to examine self-ratings of one's *actual* (i.e., current) and *desired* physique based on both the level of body fat and muscle mass. The SM-F was designed to mirror the New Somatomorphic Matrix – Male (Talbot et al., 2019), a bi-dimensional figural rating scale for men. The 34 female figures presented in the SM-F were produced using DAZ Studio 4.9 (www.Daz3d.com) the female 3D model Victoria 7.0. Female figures on the x-axis (representing variation in body fat percentage) and on the y-axis (representing variation in muscle mass) were generated based on two unidimensional figural rating scales – the Presentation of Images on a Continuum Scale, an established scale which has displayed good evidence of convergent and concurrent validity (Novella et al., 2015). The head of each body stimulus was occluded by a black ellipse to prevent distraction away from the body, and to prevent conflating attractiveness of the face with attractiveness of the body (Gardner et al., 2009). Participants used their mouse pointer to click (or touchscreen to touch) on the image to respond to each scale. Each axis was measured in pixel length: the muscularity scale (y-axis) was 3541 pixels and the body fat scale (x-axis) was 2295 pixels. Responses were measured in pixel coordinates in terms of position on the appropriate scale and transformed into a score from 0-100. That is, body fat percentage (x-axis) was scored from 0 to 100, with 0 representing a body with very little fat (i.e., an underweight body) and 100 representing the body with the highest fat percentage (i.e., an obese body). Analogously, muscle mass (y-axis) was scored from 0 to 100, with 0 representing a body with very little muscularity, and 100 representing hyper-muscularity. Once presented with the

SM-F, participants were asked the following: (a) “Please click/touch the location on the grid that best corresponds to your *actual body*”, (b) “please click/touch the location on the grid that best corresponds to your *desired body* (i.e., the body you would most like to have as your own)”. The sequence of these questions was consistent across all participants. Discrepancy scores for body fat were calculated by subtracting *desired scores* from *actual* scores. Discrepancy scores for muscularity are calculated inversely: by subtracting *actual* scores from *desired* scores. As it was anticipated that most women would strive for both thinner bodies with more muscle tone, inversely scoring muscularity discrepancy scores would ensure consistency in terms of the direction of score value. Thus, for both body fat and muscularity, larger discrepancy scores indicate a greater difference between one’s perceived *actual* and *desired* body.

Eating Disorder Examination – Questionnaire. The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994) was used to measure eating disorder symptoms. The questionnaire includes 28 items with mixed response scales including a 7-point rating scale and a forced-choice scheme to assess the number of days on which particular behaviors occurred or attitudes were expressed. Higher scores on the respective subscales indicate stronger endorsement of eating disorder symptoms. Responses were summed across the four subscales: (a) restraint, (b) eating concern, (c) shape concern, (d) weight concern. The EDE-Q is a valid and reliable measure for indexing eating disorder symptoms among non-clinical university women (Berg et al., 2012; Quick & Byrd-Bredbenner, 2013; Rose et al., 2013).

Body Shape Questionnaire-34. The Body Shape Questionnaire-34 (BSQ; Cooper et al., 1987) was used to measure body dissatisfaction. Participants were asked to rate how often they experienced body or weight/shape concerns from 1 (*Never*) to 6 (*Always*). Responses were summed to provide a global score, with higher scores indicative of greater body dissatisfaction.

The BSQ-34 shows sound psychometric properties for use with women (Cooper et al., 1987; Varnado-Sullivan, 2006).

Depression Anxiety Stress Scales-21. The 21-item Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995) were used to measure symptoms of depression, anxiety, and stress (7 items pertaining to each). Responses were rated on a 4-point scale ranging from 0 (*Did not apply to me over the past week*) to 3 (*Applied to me very much or most of the time over the past week*). Scores on each scale were summed, with higher scores indicative of more severe symptoms of depression, anxiety, and/or stress. The DASS-21 has demonstrated sound psychometric properties in non-clinical samples of women (Antony et al., 1998; Henry & Crawford, 2005; Norton, 2007).

Procedure

Participants accessed all measures via hyperlink and completed measures on their personal devices. After providing informed consent, participants were presented with demographic and anthropometric questions first, after which they completed all other self-report measures in a randomized order. Participants could withdraw from the study at any point. Ethics approval for the study was granted by *** (*University name withheld until post-review*) University's Human Research Ethics Committee (protocol #: H11778).

Data analysis plan

All analyses were conducted using RStudio (Version 1.4.1717) and involved four stages. Pearson's correlations were calculated to provide preliminary evidence for the validity of the SM-F. To account for missing data, 72 participants were removed from the correlational analysis via listwise deletion. First, to examine content validity (*HI*), paired sample *t*-tests examined differences between *actual* and *desired* body ratings for both body fat and muscle mass

dimensions. Second, to examine convergent validity (*H2*), SM-F *actual* body fat and *actual* muscularity were each correlated with BMI, with evidence of convergent validity being positive correlations between *actual* scores and BMI. Third, SM-F body fat and muscularity discrepancy scores were correlated with global scores on the BSQ-34, with evidence of concurrent validity (*H3*) being positive correlations between discrepancy scores and BSQ scores. The SM-F body fat and muscularity discrepancy scores were also correlated with subscale scores on the EDE-Q, with positive correlations evidencing concurrent validity (*H4*). Additionally, Steiger's *z* (Myers & Sirois, 2006; Steiger, 1980) was used to compare the correlations of BSQ-34 with both body fat discrepancy and muscularity discrepancy scores. Last, to examine discriminant validity (*H5*), SM-F body fat and muscularity discrepancy scores were correlated with the depression, anxiety, and stress scales of the DASS-21. Then, Steiger's *z* compared the strength of these correlations, with evidence of discriminant validity being stronger correlations between discrepancy scores and the BSQ-34, compared to correlations between discrepancy scores and the DASS-21 scales.

Results

Validation of SM-F

Descriptive statistics and correlations among Study 1 variables are shown in Table 1 and a heatmap of individual responses for *actual* and *desired* body fat and muscularity are shown in Figure 2a and 2b. Of note, 85.85% of women reported desiring less body fat, 68.54% desired greater muscularity, and 62.44% desired both less body fat and greater muscularity than their reported perceived actual body.

Content Validity. Consistent with *H1*, results showed that on average, women's desired level of body fat was lower than their actual level body fat, $t(409) = 17.83, p < .001, d = 0.96$. Conversely, women's desired level of muscularity was higher than their actual level of

muscularity, $t(409) = 7.80, p < .001, d = 0.43$. Distributions for body fat and muscularity discrepancy scores are shown in Figure 3.

Convergent Validity. Results from our correlational analysis (Table 1) partially supported $H2$, with reported *actual body fat* significantly correlated with BMI. However, *actual muscularity* scores did not correlate with BMI.

Concurrent Validity. In line with $H3$, both body fat and muscularity discrepancy scores were positively correlated with body dissatisfaction scores. Notably, the correlation between *SM-F body fat discrepancy and body dissatisfaction* was significantly stronger ($r = .39$) than the correlation between *SM-F muscularity discrepancy and body dissatisfaction* ($r = .10$), $z = 5.28, p < .001$, thus displaying some discriminant validity. Additionally, body fat discrepancy scores were significantly positively correlated with all four EDE-Q subscales ($H4$); however, muscularity discrepancy scores were only positively correlated with Eating Concern, Weight Concern, and Shape Concern.

Discriminant Validity. To examine discriminant validity ($H5$), SM-F body fat and muscularity discrepancy scores were correlated with the depression, anxiety, and stress scales of the DASS-21, and then the strength of these correlations were compared. Unexpectedly, we did observe significant correlations between the discrepancy scores and measures of depression, anxiety, and stress. However, these correlations were small. Though the body fat discrepancy scores showed small correlations with depression and stress, a post-hoc comparison showed evidence of discriminant validity as the SM-F body fat discrepancy scores were more strongly correlated with body dissatisfaction than with depression ($z = 4.21, p < .001$), anxiety ($z = 4.64, p < .001$), and stress ($z = 4.30, p < .001$). However, SM-F muscularity discrepancy showed small correlations with body dissatisfaction and with anxiety and depression. Furthermore, the

magnitudes of these correlations were similar, and thus there was no significant difference in strength between the correlation of SM-F muscularity discrepancy and body dissatisfaction and the respective correlations with depression ($z = 0.15, p = .88$), anxiety ($z = -0.42, p = .68$), or stress ($z = -0.31, p = .76$).

Discussion

Study 1 aimed to provide preliminary evidence for the validity of the SM-F – a bidimensional matrix figural rating scale for women. Overall, our findings support the SM-F as a useful and valid measure of discrepancies between one's actual and desired body, and related body dissatisfaction. As predicted (*H1*), Australian undergraduate women rated their *desired* body as more muscular and leaner than their perceived actual body. This result corresponds with what Steinfeld et al. (2020) found in German undergraduate women using the BIMTM-FB.

The SM-F showed convergent validity (*H2*) as evidenced through a positive association between *actual* body fat scores and BMI, suggesting that women can select a body (or point) on the figural scale that corresponds with their (perceived) actual body size. The same results were not found for measures of *actual* muscularity, which did not correlate with BMI. This is likely accounted for by the fact that BMI is not a direct measure of muscular bulk, and for individuals from the general population (as opposed to specific low-fat groups like athletes), BMI is far more likely to be dictated by body fat as opposed to muscularity (McCreary et al., 2006). Of note, these results were similar to what Steinfeld et al. (2020) found in German women using the BIMTM-FB. Notably, in Steinfeld et al.'s (2020) undergraduate sample there was no association between BMI and *actual* muscularity scores ($r = .09, p$ value not reported). Further, in their community sample there was a significant, albeit relatively low correlation between BMI and

292 *actual* muscularity scores ($r = .16$) (compared to their correlation between BMI and *actual* body
293 fat).

294 The SM-F also exhibited concurrent validity (*H3*) as discrepancy scores on body fat and
295 muscularity dimensions were positively associated with body dissatisfaction. Of note, the
296 correlation between body fat discrepancy and body dissatisfaction was significantly higher than
297 that of muscularity discrepancy and body dissatisfaction. It may be plausible that women's
298 pursuit of lower body fat is a stronger contributor to body dissatisfaction than women's drive for
299 muscularity, or that the SM-F is a less precise measure of muscularity compared to body fat.
300 Alternatively, this finding may reflect a methodological limitation of the BSQ-34 and its
301 conceptual measurement of body dissatisfaction. Many items are heavily geared towards
302 assessing dissatisfaction relating specifically to body fat (e.g., "*Has eating even a small amount*
303 *of food made you feel fat?*", "*Have you been afraid that you might become fat?*"). Other items
304 require participants to reflect on the shape and firmness of their body, however no item directly
305 requires participants to reflect on their muscularity. In this way, the BSQ-34 may not be
306 adequately indexing body dissatisfaction as it pertains to muscularity, accounting for the
307 relatively small correlation between scores on this measure and muscularity discrepancy.

308 The SM-F demonstrated further concurrent validity through examination of associations
309 between discrepancy scores and eating disorder symptomatology (*H4*). Body fat discrepancy
310 scores positively correlated with all four EDE-Q subscales, whilst muscularity discrepancy
311 scores positively correlated with all subscales except for Restraint. We speculate this could be
312 accounted for by the nature of the items within the Restraint subscale. Specifically, the items
313 which comprise this subscale centrally examine the restriction of food intake (e.g., "*Have you*
314 *gone for long periods of time (8 waking hours or more) without eating anything at all in order to*

influence your shape or weight”), which may be more relevant in the context of the drive for thinness (i.e., reducing body fat) rather than muscularity. Although it is likely that some women may engage in restricted eating to enhance the tone of their muscularity (i.e., reduce body fat with the intention of making one’s muscles appear more ‘sculpted’), others may intake a surplus of calories and large amounts of protein to support *muscle growth* (Murray et al., 2010; Murray et al., 2017). The lack of an association between muscularity discrepancy and Restraint may reflect their complex (non-linear) relationship, and that restrained eating patterns may be engaged (or not) depending on different intentions regarding muscularity (e.g., pursuit of muscle tone vs. growth; Griffiths et al., 2013; Murray et al., 2017).

Our fifth hypothesis, predicting that there would be stronger correlations between discrepancy scores and body dissatisfaction compared to discrepancy scores and depression, anxiety, and stress was partially supported. The SM-F body fat discrepancy scores were more strongly correlated with body dissatisfaction than with depression, anxiety, and stress, suggesting that the SM-F body fat dimension is more sensitive to indexing body dissatisfaction than general measures of aversive emotional states. However, muscularity discrepancy scores were not significantly more strongly correlated with body dissatisfaction scores compared to the correlation between body dissatisfaction scores and depression, anxiety, and stress scores. This likely reflects the small correlation between the SM-F muscularity discrepancy score and body dissatisfaction scores, which, as discussed above, may be due to a methodological limitation of the BSQ-34.

Study 2

Study 2 aimed to address limitations identified in Study 1, notably the use of a non-muscularity specific measure to examine concurrent validity, and confirm that the body fat and muscularity index scores derived from the SM-F were differentially sensitive to an individual's desire to be thinner and/or more muscular, respectively. Therefore, we aimed to show that the SM-F body fat discrepancy scores were positively correlated with self-reported drive for thinness, and that SM-F muscularity discrepancy scores were correlated with a theoretically relevant muscularity construct, drive for muscularity.

Method

Participants

A total of 419 women commenced the online survey. Of these, 15 failed an embedded survey item used as an attention check and 22 had missing data. These participants were removed from the dataset, leaving our final sample of 382 female undergraduate psychology students from a large public Australian university who participated and were reimbursed with course credit. Participants were aged between 18 and 47 years ($M = 20.17$, $SD = 3.49$), with most reportedly living in Australia (96.07%) and predominantly identified as exclusively heterosexual (67.02%). Participants identified their ethnicity as Caucasian/British (31.20%), East Asian (28.80%), South Asian (13.61%), and other (26.44%). Participants reported on their weight and height, which was used to calculate body mass index (BMI; kg / m^2), with a mean BMI of 21.57 ($SD = 3.47$; $range = 14.01 - 44.06$).

Measures

Somatomorphic Matrix-Female. Analogous to Study 1, the SM-F was used to examine self-ratings of one's *actual* and *desired* physique based on both the level of body fat and muscle

mass. Each axis had a slightly different pixel length compared to Study 1: the muscularity scale (y-axis) was 1758 pixels and the body fat scale (x-axis) was 1137 pixels.

Drive for Thinness. Drive for thinness was measured using a subscale of the Eating Disorder Inventory – 3 (EDI-3; Garner, 2004). The measure includes 7 items (e.g., “I exaggerate or magnify the importance of weight”) on a 6-point rating scale ranging from 1 (*never*) to 6 (*always*) and summed, with higher scores indicative of a greater drive for thinness. The EDI-3 demonstrates good psychometric properties including internal consistency and discriminative validity in clinical and community samples of women (Clausen et al., 2011).

Drive for Muscularity. Drive for muscularity was measured using the Drive for Muscularity Scale (McCreary & Sasse, 2000). The measure includes 15 items (e.g., “I think I would feel more confident if I had more muscle mass”) with responses made on a 6-point rating scale ranging from 1 (*never*) to 6 (*always*), and summed with higher scores indicative of a greater drive for muscularity. Previous research has suggested dropping one item in the measure related to steroid ideation (i.e., “*I think about taking anabolic steroids*”; McCreary et al., 2004). However, we opted to retain this item given its theoretical relevance to women who desire to put on sizeable muscle bulk (as we have figural bodies reflecting overt and large-scale muscularity). The scale shows sound psychometric properties in a young sample of women including test-retest reliability, in addition to convergent and discriminant validity (de Carvalho et al., 2019).

Procedure

The study was advertised through The University of *** (*University name withheld until post-review*) student research participation platform. After the provision of informed consent, participants responded to the self-report instruments in a randomized order (apart from sociodemographic questions and the figural scales which were presented first). The study took

approximately 15 minutes to complete. Participants could participate in the online study using a desktop computer or personal device (using touchscreen). An attention check item was embedded in the survey that asked participants to choose a specific response option if they had read the item; participants were completely removed from the dataset if this response option was not selected. The Human Research Ethics Committee at *** University approved this study.

Data analysis plan

All analyses were conducted using RStudio (Version 1.4.1717) and involved four stages. Pearson's correlations were calculated to provide evidence for a relationship between SM-F and the DFT and DFM. 15 participants responded incorrectly to an attention check and 22 participants had missing data – these participants were removed from the analysis via listwise deletion. First, to examine content validity (*H1*), paired sample *t*-tests examined differences between *actual* and *desired* body ratings for both body fat and muscle mass dimensions. Second, to examine convergent validity (*H2*), SM-F *actual* body fat and *actual* muscularity were each correlated with BMI, with evidence of convergent validity being positive correlations between *actual* scores and BMI. Third, SM-F body fat and muscularity discrepancy scores were correlated with global scores on the BSQ-34, with evidence of concurrent validity (*H3*) being positive correlations between discrepancy scores and BSQ scores. The SM-F body fat and muscularity discrepancy scores were also correlated with subscale scores on the EDE-Q, with positive correlations evidencing concurrent validity (*H4*). Additionally, Steiger's *z* (Myers & Sirois, 2006; Steiger, 1980) was used to compare the correlations of BSQ-34 with both body fat discrepancy and muscularity discrepancy scores. Last, to examine discriminant validity (*H5*), SM-F body fat and muscularity discrepancy scores were correlated with the depression, anxiety, and stress scales of the DASS-21. Then, Steiger's *z* compared the strength of these correlations,

with evidence of discriminant validity being stronger correlations between discrepancy scores and the BSQ-34, compared to correlations between discrepancy scores and the DASS-21 scales.

Results

Validation of SM-F

Descriptive statistics and correlations among Study 2 variables are presented in Table 2, and a heatmap of individual responses for *actual* and *desired* body fat and muscularity are shown in Figure 2c and 2d. Similar to results found in Study 1, 89.01% of women reported desiring less body fat, 71.50% desired greater muscularity, and 63.61% desired both less body fat and greater muscularity than their reported perceived actual body. Additionally, results showed that participants' desired level of body fat was lower than their actual level of body fat, $t(381) = 22.33, p < .001, d = 1.20$. Conversely, desired level of muscularity was higher than their actual level of muscularity, $t(381) = 10.78, p < .001, d = 0.63$.

The SM-F body fat *actual* scores positively correlated with drive for thinness, whereas there was no evidence that actual, desired and discrepancy body fat scores significantly correlated with drive for muscularity. Moreover, *desired* body fat scores correlated negatively with drive for thinness. Discrepancy body fat scores positively correlated with drive for thinness. Finally, *actual*, *desired* and discrepancy SM-F body fat scores positively correlated with BMI.

Desired muscularity scores and the muscularity *discrepancy* scores were positively correlated with drive for muscularity and negatively correlated with drive for thinness. *Actual* muscularity scores showed small, but significant, positive correlations with both drive for thinness and drive for muscularity. Additionally, *actual* muscularity scores were positively correlated with BMI.

Discussion

Study 2 provides preliminary support that the body fat and muscularity scales of the SM-F were differentially sensitive to an individual's desire to be thinner and/or more muscular, respectively. The SM-F body fat measures were correlated with a drive for thinness, whereas these measures showed no relationship with the drive for muscularity. This suggests that the SM-F body fat scale is specifically sensitive to body dissatisfaction relating to one's level of body adiposity. Importantly, this study builds upon Study 1 by demonstrating that *desired* and *discrepancy* muscularity measures of the SM-F correspond with an individual's drive to be more (or less) muscular, demonstrating its utility as an indirect measure of muscularity dissatisfaction. Notably, *actual* muscularity scores (as well as *actual* body fat scores) were, in this sample, significantly positively correlated with BMI. This is in contrast to Study 1 which, in an attempt to examine convergent validity, found no significant association between *actual* muscularity and BMI. This difference might be a reflection of the difference in body fat percentage between the two samples. Notably, women from Study 1 reported their perceived actual body fat as greater ($M = 46.75$) than women from Study 2 ($M = 41.28$; $t(752.86) = 4.73$, $p < .001$, $d = 0.33$), meaning that BMI might be driven more by body fat in the sample from Study 1. However, this explanation is undermined by the fact that women from Study 1 also reported greater perceived *actual* muscularity ($M = 36.67$) compared to women in Study 2 ($M = 33.10$; $t(722.73) = 3.04$, $p = .003$, $d = 0.21$), and had a greater mean BMI in general (25.08 compared to 21.58; $t(664.64) = 10.441$, $p < .001$, $d = 0.73$).

General Discussion

Findings from Study 1 and 2 provide preliminary evidence that the SM-F is a valid index of body dissatisfaction. In Study 1, we demonstrated that ratings on the SM-F are sensitive to detecting general body dissatisfaction, as well as predicting specific theoretically relevant

450 markers of problematic body image, such as eating disorder symptomatology. Further, the SM-F
451 displayed evidence for discriminant validity for body fat discrepancy scores, but not for
452 muscularity discrepancy scores compared with non-appearance-focused constructs, namely
453 symptoms of depression, anxiety and stress. Study 2 builds upon these findings, highlighting the
454 SM-F as a sensitive measure for detecting drives for muscularity and thinness, and that the SM-F
455 body fat and muscularity dimensions correlate with corresponding appearance-related drives
456 (i.e., drives for thinness and muscularity, respectively).

457 The development and validation of the SM-F is timely given the mounting evidence of
458 the importance of both body fat and muscularity levels in determining how satisfied women feel
459 about their bodies. The scale builds on the utility of bi-dimensional figural rating scales in
460 measuring components and related psychological factors of female body image, thus
461 emphasizing the importance of tapping into both body fat and muscularity together, especially
462 among women and the aspirational toned muscular appearance ideal (i.e., low body fat *in*
463 *combination* with muscularity).

464 Findings from both studies clearly reinforce this point: Overall, participants desired a
465 body type comprising a lower level of body fat and a higher level of muscularity than they
466 currently believe they have. Evidently, over half of participants in Study 1 (51.4%) and Study 2
467 (62.0%) desired both less body fat and greater muscularity than they perceived to have currently.

468 It is also especially important to tap into both perceptions of body fat and muscularity
469 using a unitary measure as these aspects of appearance are likely to fluctuate somewhat with
470 each other. This may be particularly relevant among individuals employing body change
471 behaviors to ‘improve’ some aspect of their appearance. For instance, special eating practices for
472 the purposes of further developing one’s musculature, by virtue of a surplus of dietary calories

necessary to support this process, can be associated in tandem with a gain in body fat and body fat dissatisfaction (Lavender et al., 2017). Conversely, dieting with the intention of reducing body adiposity (i.e., ‘cutting’) may curtail muscular development (and elicit muscularity dissatisfaction) as one might not be consuming sufficient macronutrients (e.g., protein) (Lavender et al., 2017). Particularly among (the many) women who employ body change behaviors to influence their weight or shape, measures which tap into actual and idealized body fat and muscularity levels on separate continua are limited in their ecological validity. Specifically, in the real world, it is unlikely that one of these facets of appearance would change while the other is held constant (an implicit assumption of such scales).

Strengths and Implications. Our study has several strengths and potential important implications for both researchers and clinicians. First, our study builds upon Steinfeld and colleagues’ (2020) BIMTM-FB by providing further evidence supporting the validity and use of bi-dimensional figural ratings scales in body image research. Notably, the present study has uniquely utilized the BSQ-34 and the EDE-Q to examine concurrent validity in an undergraduate Australian sample, showing that scores on the SM-F are sensitive in detecting these constructs, and has included occluded faces in constructing the figural rating scale as opposed to removing faces from figures, thus avoiding any potential visual processing biases (Robbins & Coltheart, 2012; Soria Bauser & Suchan, 2018). Further, the present paper is the first to directly examine the validity of actual-desired discrepancy scores provided by a female bi-dimensional figural rating scale, finding that these scores are sensitive to detecting body dissatisfaction, eating disorder symptoms, and drive for thinness and muscularity.

Second, the SM-F provides a quick measure of actual-idealized body discrepancies, and indirectly, body dissatisfaction in relation to two integral parts of women’s body image. As the

measure is free from text-based questions found in conventional measures, we believe the SM-F will be a useful tool for cross-cultural research and non-student community samples (who may not be as highly literate). Third, in addition to a quantitative indicator, the SM-F allows end users to glean a visual representation of how women perceive their bodies – and those which they are driven to attain – information which is impossible to obtain through solely quantitative-based methods.

Additionally, pending future research, we hope the SM-F will have useful clinical applications. For instance, extant literature has consistently demonstrated that distortions in one's weight, shape, and appearance are key clinical indicators of several body image-related psychopathologies including eating disorders (e.g., anorexia nervosa) and body dysmorphic disorder (American Psychiatric Association, 2013; Madsen et al., 2013). Visual ratings of how an individual perceives their actual body could be readily compared to similar ratings from trained clinicians to assess whether a distorted perception in one's appearance may exist, and therefore require addressing. The SM-F could also provide useful information to clinicians about the unhealthy body change practices that individuals are at risk of engaging in to move themselves closer to their idealized appearance. For example, if a woman idealizes greater muscularity but is content with her current level of body fat, she may exhibit a proclivity for engaging in muscularity-oriented eating and exercise, including overregulation of protein-rich foods or frequent strenuous weights-based activities. Conversely, women who perceive greater discrepancies in their actual and idealized levels of body fat (and those who are more or less satisfied with their current muscularity) may be driven to using harmful thinness-oriented eating and exercise practices in an effort to reduce body adiposity (e.g., fasting for prolonged periods, intense cardiovascular exercise). The importance of considering both perceptions about body fat

and muscularity in a clinical setting is highlighted in a recent case study (Murray et al., 2018). Briefly, the study describes a young boy who was treated primarily for thinness-oriented pathology (anorexia nervosa), however concurrently experienced a marked increase in muscularity-oriented pathology. This transition in symptomatology skirted the attention of clinicians, potentially due to the lack of availability of a purposive instrument to index the drive for higher muscularity. This case study underscores the importance of assessing and monitoring perceptions of both body fat and muscularity in relevant clinical settings (e.g., with eating disorders), and the SM-F may provide a useful means to achieve this. We concede that although these potential applications of the SM-F are promising, future research in clinical populations will be important in determining whether such benefits come to fruition.

Limitations and Future Research. We view our findings in light of several study limitations. First, the SM-F comprises bodies with Caucasian skin pigmentation only, potentially reducing the extent to which non-Caucasian women identify with the figures in the scale and impact external validity (Talbot et al., 2019). Tellingly, when examining an analogous issue in relation the New Somatomorphic Matrix – Male, Talbot et al. (2019) found no effect of ethnicity on body selections. Future research will aim to examine the impact of race and ethnicity on body selections on the SM-F. Second, by nature of its cross-sectional design, our study did not collect data allowing us to gauge the reliability of the SM-F (e.g., test-retest reliability). Prospective research should aim to employ longitudinal designs to address this limitation. Lastly, the study was limited by its reliance on BMI to examine the convergent validity of the muscularity dimension of the SM-F, and the omission of a biometric measure of muscularity. This is likely the reason that, across both studies, BMI correlated with the body fat measures of the SM-F but

not consistently with the muscularity measures. Additional evidence for the validity of the SM-F will be found in future research correlating biometric measures with self-reported SM-F ratings.

Conclusion. Limitations notwithstanding, overall, the SM-F represents a new bidimensional female figural rating scale, demonstrating sound content, convergent, and concurrent validity. Future studies should aim to examine the concurrent validity of the muscular dimension SM-F using biometric measures of muscularity such as the Fat Free Mass Index (Kouri et al., 1995), as well as evaluating the test-retest reliability of the SM-F in order to ascertain whether the discrepancy scores are consistent over time. Additionally, future studies should examine the validity of the SM-F for use in clinical populations.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th Ed. ed.). Arlington, VA: American Psychiatric Publishing.
- Bozsik, F., Whisenhunt, B. L., Hudson, D. L., Bennett, B., & Lundgren, J. D. (2018). Thin is in? Think again: The rising importance of muscularity in the thin ideal female body. *Sex Roles*, 79(9-10), 609-615. doi:10.1007/s11199-017-0886-0
- Brausch, A. M., & Gutierrez, P. M. (2009). The role of body image and disordered eating as risk factors for depression and suicidal ideation in adolescents. *Suicide and Life-Threatening Behavior*, 39(1), 58-71. doi:10.1521/suli.2009.39.1.58
- Cass, J., Giltrap, G., & Talbot, D. (2020). Female body dissatisfaction and attentional bias to body images evaluated using visual search. *Frontiers in Psychology*, 10, 2821. doi: 10.3389/fpsyg.2019.02821
- Choi, P. Y. L. (2000). *Femininity and the physically active woman*. London: Routledge.
- Clausen, L., Rosenvinge, J. H., Friborg, O., & Rokkedal, K. (2011). Validating the Eating Disorder Inventory-3 (EDI-3): A comparison between 561 female eating disorders patients and 878 females from the general population. *Journal of Psychopathology and Behavioral Assessment*, 33(1), 101-110. doi: 10.1007/s10862-010-9207-4
- Cunningham, M. L., Szabo, M., Kambanis, P. E., Murray, S. B., Thomas, J. J., Eddy, K. T., ... & Griffiths, S. (2019). Negative psychological correlates of the pursuit of muscularity among women. *International Journal of Eating Disorders*, 52(11), 1326-1331. doi: 10.1002/eat.23178

- de Carvalho, P. H. B., da Costa Oliveira, F., Neves, C. M., Meireles, J. F. F., & Ferreira, M. E. C. (2019). Is the Drive for Muscularity Scale a valid and reliable instrument for young adult women?. *Body Image*, 29, 1-5. doi: 10.1016/j.bodyim.2019.02.001.
- del Mar Bibiloni, M., Coll, J. L., Pich, J., Pons, A., & Tur, J. A. (2017). Body image satisfaction and weight concerns among a Mediterranean adult population. *BMC Public Health*, 17(1), 39. doi: 10.1186/s12889-016-3919-7.
- Eik-Nes, T. T., Austin, S. B., Blashill, A. J., Murray, S. B., & Calzo, J. P. (2018). Prospective health associations of drive for muscularity in young adult males. *International Journal of Eating Disorders*, 51(10), 1185-1193. doi:10.1002/eat.22943
- Fiske, L., Fallon, E. A., Blissmer, B., & Redding, C. A. (2014). Prevalence of body dissatisfaction among United States adults: Review and recommendations for future research. *Eating Behaviors*, 15(3), 357-365. doi:10.1016/j.eatbeh.2014.04.010
- Frederick, D. A., Buchanan, G. M., Sadehgi-Azar, L., Peplau, L. A., Haselton, M. G., Berezovskaya, A., & Lipinski, R. E. (2007). Desiring the muscular ideal: Men's body satisfaction in the United States, Ukraine, and Ghana. *Psychology of Men & Masculinity*, 8(2), 103. doi:10.1037/1524-9220.8.2.103
- Frederick, D. A., Garcia, J. R., Gesselman, A. N., Mark, K. P., Hatfield, E., & Bohrnstedt, G. (2020). The Happy American Body 2.0: Predictors of affective body satisfaction in two US national internet panel surveys. *Body Image*, 32, 70-84. doi: 10.1016/j.bodyim.2019.11.003
- Garner, D. M. (2004). *Eating Disorder Inventory-3 Professional Manual*. Lutz, FL: Psychological Assessment Resources.

- Gerner, B., & Wilson, P. H. (2005). The relationship between friendship factors and adolescent girls' body image concern, body dissatisfaction, and restrained eating. *International Journal of Eating Disorders*, 37(4), 313-320. doi:10.1002/eat.20094
- Griffiths, S., Hay, P., Mitchison, D., Mond, J. M., McLean, S., Rodgers, B., et al. (2016). Sex differences in the relationships between body dissatisfaction, quality of life and psychological distress. *Australian and New Zealand Journal of Public Health*, 40(6), 518–522. doi:10.1111/1753-6405.12538
- Griffiths, S., Murray, S. B., & Touyz, S. W. (2013). Disordered eating and the muscular ideal. *Journal of Eating Disorders*, 1(1), 15. doi:10.1186/2050-2974-1-15
- Grogan, S. (2016). Body image: Understanding body dissatisfaction in men, women and children. *Taylor & Francis*. doi: 10.4324/9781315681528
- Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British Journal of Clinical Psychology*, 44(2), 227-239. doi: 10.1348/014466505X29657
- Hildebrandt, T., Langenbucher, J., & Schlundt, D. G. (2004). Muscularity concerns among men: Development of attitudinal and perceptual measures. *Body Image*, 1(2), 169-181. doi: doi.org/10.1016/j.bodyim.2004.01.001
- IBM. (2017). IBM SPSS statistics for windows, version 25.0. Armonk: IBM Corp.
- Kouri, E. M., Pope Jr, H. G., Katz, D. L., & Oliva, P. (1995). Fat-free mass index in users and nonusers of anabolic-androgenic steroids. *Clinical journal of sport medicine: official journal of the Canadian Academy of Sport Medicine*, 5(4), 223-228. doi: 10.1097/00042752-199510000-00003.

- Madsen, S. K., Bohon, C., & Feusner, J. D. (2013). Visual processing in anorexia nervosa and body dysmorphic disorder: similarities, differences, and future research directions. *Journal of Psychiatric Research*, 47, 1483–1491. doi:10.1016/j.jpsychires.2013.06.003.
- McCreary, D. R., Karvinen, K., & Davis, C. (2006). The relationship between the drive for muscularity and anthropometric measures of muscularity and adiposity. *Body Image*, 3(2), 145-152. doi: 10.1016/j.bodyim.2006.01.006
- McCreary, D. R., & Sasse, D. K. (2000). An exploration of the drive for muscularity in adolescent boys and girls. *Journal of American College Health*, 48, 297–304. doi: 10.1080/07448480009596271
- McCreary, D. R., Sasse, D. K., Saucier, D. M., & Dorsch, K. D. (2004). Measuring the drive for muscularity: factorial validity of the drive for muscularity scale in men and women. *Psychology of Men & Masculinity*, 5(1), 49. doi: 10.1037/1524-9220.5.1.49
- McLean, S. A., Wertheim, E. H., & Paxton, S. J. (2018). Preferences for being muscular and thin in 6-year-old boys. *Body Image*, 26, 98–102. doi:10.1016/j.bodyim.2018.07.003
- Mond, J., Mitchison, D., Latner, J., Hay, P., Owen, C., & Rodgers, B. (2013). Quality of life impairment associated with body dissatisfaction in a general population sample of women. *BMC Public Health*, 13(1), 920. doi:10.1186/1471-2458-13-920
- Murray S. B., Nagata, J. M., Griffiths S., et al. (2017). The enigma of male eating disorders: A critical review and synthesis. *Clinical Psychology Review*, 57, 1-11. doi:10.1016/j.cpr.2017.08.001
- Murray, S. B., Rieger, E., Touyz, S. W., & De la Garza García, Y (2010). Muscle dysmorphia and the DSM-V conundrum: where does it belong? A review paper. *International Journal of Eating Disorders*, 43, 483–491. doi:10.1002/eat.20828

- Mutale, G. J., Dunn, A. K., Stiller, J., & Larkin, R. (2016). Development of a body dissatisfaction scale assessment tool. *The New School Psychology Bulletin*, 13(2), 47-57.
- Myers, L., & Sirois, M. J. (2004). Pearson correlation coefficients, differences between. *Encyclopedia of Statistical Sciences*, 12. doi: 10.1002/0471667196.ess5050.pub2
- Neighbors, L. A., & Sobal, J. (2007). Prevalence and magnitude of body weight and shape dissatisfaction among university students. *Eating Behaviors*, 8(4), 429-439. doi:10.1016/j.eatbeh.2007.03.003
- Norton, P. J. (2007). Depression Anxiety and Stress Scales (DASS-21): Psychometric analysis across four racial groups. *Anxiety, Stress, and Coping*, 20(3), 253-265. doi:10.1080/10615800701309279
- Novella, J., Gosselin, J. T., & Danowski, D. (2015). One size doesn't fit all: New continua of figure drawings and their relation to ideal body image. *Journal of American College Health*, 63(6), 353-360. doi:10.1080/07448481.2015.1040410
- Pope, H. G., Jr., Khalsa, J. H., & Bhasin, S. (2016). Body image disorders and abuse of anabolic-androgenic steroids among men. *JAMA*, 317, 23-24. doi:10.1001/jama.2016.17441
- Ralph-Nearman, C., & Filik, R. (2018). New Body Scales Reveal Body Dissatisfaction, Thin-Ideal, and Muscularity-Ideal in Males. *American Journal of Mens Health*, 12(4), 740-750. doi: 10.1177/1557988318763516
- Ralph-Nearman, C., & Filik, R. (2020). Development and validation of new figural scales for female body dissatisfaction assessment on two dimensions: thin-ideal and muscularity-ideal. *BMC Public Health*, 20(1), 1-11. doi: 10.1186/s12889-020-09094-6

- Ridgeway, R. T., & Tylka, T. L. (2005). College Men's Perceptions of Ideal Body Composition and Shape. *Psychology of Men & Masculinity*, 6(3), 209-220. doi:10.1037/1524-9220.6.3.209
- Robbins, R. A., & Coltheart, M. (2012). The effects of inversion and familiarity on face versus body cues to person recognition. *Journal of Experimental Psychology: Human Perception and Performance*, 38(5), 1098–1104. doi:10. 1037/a0028584
- Rodgers, R.F., Franko, D.L., Lovering, M.E., Luk, S., Pernal, W., & Matsumoto, A. (2018). Development and validation of the Female Muscularity Scale. *Sex Roles*, 78, 18-26. doi:10.1007/s11199-017-0775-6
- Rose, J. S., Vaewsorn, A., Rosselli-Navarra, F., Wilson, G. T., & Weissman, R. S. (2013). Test-retest reliability of the eating disorder examination-questionnaire (EDE-Q) in a college sample. *Journal of Eating Disorders*, 1(1), 42. doi:10.1186/2050-2974-1-42
- Soria Bauser, D., & Suchan, B. (2018). The role of the head in configural body processing: Behavioural and electrophysiological evidence from the inversion and scrambling effect. *British Journal of Psychology*, 109, 564– 582. doi:10.1111/bjop.12287
- Steiger, J. H. (1980). Tests for comparing elements of a correlation matrix. *Psychological Bulletin*, 87, 245-251. doi:10.1037/0033-2909.87.2.245
- Steinfeld, B., Hartmann, A. S., Waldorf, M., & Vocks, S. (2020). Development and initial psychometric evaluation of the Body Image Matrix of Thinness and Muscularity–Female Bodies. *Journal of Eating Disorders*, 8(1), 1-12. doi: 10.1186/s40337-020-00345-w
- Swami, V., Salem, N., Furnham, A., & Tovée, M. J. (2008). Initial examination of the validity and reliability of the female photographic figure rating scale for body image

assessment. *Personality and Individual Differences*, 44(8), 1752-1761.

doi:10.1016/j.paid.2008.02.002

Talbot, D., Cass, J., & Smith, E. (2019). Visual Body Scale for Men (VBSM): Validation of a new figural rating scale to measure actual-desired body discrepancy in men. *Journal of Clinical Psychology*, 75(3), 462-480. doi:10.1002/jclp.22710

Talbot, D., Cass, J., & Smith, E. (2020). Male Figural Rating Scales: A Critical Review of the Literature. *Behaviour Change*, 37(2). doi: 10.1017/bec.2020.5

Talbot, D., Smith, E., Cass, J., & Griffiths, S. (2019). Development and validation of the New Somatomorphic Matrix–Male: A figural rating scale for measuring male actual–ideal body discrepancy. *Psychology of Men & Masculinities*, 20(3), 356.
doi:10.1037/men0000165

Quick, V. M., & Byrd-Bredbenner, C. (2013). Eating Disorders Examination Questionnaire (EDE-Q): norms for US college students. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 18(1), 29-35. doi:10.1007/s40519-013-0015-1

Appendix

Table 1.

Means, Standard Deviation, Internal Consistency, and Pearson's Correlations for the Actual, Desired, and Discrepancy Scores with Validation Variables (N = 410)

					EDE-Q						
	<i>M (SD)</i>	Range	BMI	BSQ-34 ($\alpha = .97$)	Restraint ($\alpha = .84$)	Eating Concern ($\alpha = .81$)	Shape Concern ($\alpha = .92$)	Weight Concern ($\alpha = .85$)	D	A	S
Body Fat											
Actual	46.75 (18.56)	0-93.03	.65***	.38***	.24***	.28***	.37***	.38***	.11*	.10*	.11*
Desired	31.26 (12.08)	13.68-81.22	.37***	.02	-.07	-.02	.05	.05*	.00	.04	-.01
Discrepancy	15.49 (17.59)	-67.10-75.08	.43***	.39***	.29***	.31***	.36***	.36***	.12*	.07	.12*
Muscularity											
Actual	36.67 (19.46)	2.85-99.92	.08	.07	.07	.07	.05	.07	.03	.07	.08
Desired	44.69 (17.59)	9.69-93.62	.04	-.03	-.01	-.08	-.06	.8	-.07	-.08	-.05
Discrepancy	-8.03(20.86)	-70.86-90.23	.04	.10*	.07	.13**	.10*	.13**	.09	.13**	.12*

Note: *** $p < .001$; ** $p < .01$; * $p < .05$; D, A, S represent the Depression, Anxiety, and Stress Scales from the DASS-21, respectively.

Table 2.

Means, Standard deviation, Internal consistency, and Pearson's Correlations for the Actual, Desired, and Discrepancy Scores with BMI, Drive for Thinness and Drive for Muscularity (N = 382)

	<i>M (SD)</i>	Body Mass Index	Drive for Thinness ($\alpha = .88$)	Drive for Muscularity ($\alpha = .88$)
Body Fat				
Actual	41.28 (13.77)	.69***	.24***	.05
Desired	26.55 (9.95)	.32***	-.16**	-.02
Discrepancy	14.73 (12.89)	.49***	.38***	.07
Muscularity				
Actual	33.10 (13.18)	.12*	.11*	.11*
Desired	42.47 (16.43)	.03	-.15**	.33***
Discrepancy	9.37 (16.98)	-.07	-.23***	.23***

Note: *** $p < .001$; ** $p < .01$; * $p < .05$

Figure 1. Means of actual and desired body selections presented on the SM-F in Study 1.

Variation in body fat was represented on the x-axis, and variation in muscularity was represented on the y-axis.

Figure 2. Approximate heatmaps of participant's individual responses including (a) selected actual body and (b) desired body in Study 1, and (c) selected actual body and (d) desired body in Study 2.

Figure 3. Continuous density distributions for body fat and muscularity discrepancy scores.

Density shows an approximation of the distribution of scores for each variable, calculated using a kernel density estimate. Panel A shows the discrepancy distributions for Study 1 and Panel B shows the discrepancy distributions for Study 2.