The Effect of Social Comparison and Body Adaptation on Body Dissatisfaction and Size Perception

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Abstract

The concept of body image incorporates two main aspects: perception and attitudes. Recent perception research has focused on how extended exposure to extreme body shapes can change perceptions of our own and other people's bodies, a process known as adaptation, while research into attitudinal aspects of body image has investigated the relationship between body dissatisfaction and social comparison – the process of comparing oneself to another. However, body image research has yet to investigate the relationship between adaptation and social comparison. In this study, we examined how the extent to which participants made social comparisons and the direction of their social comparisons affected change in perceived body size and change in body satisfaction, in a sample of 67 women aged between 18 and 35. Participants adjusted the shape of manipulated images of themselves to the size they perceived to be their current shape before and after exposure to adaptation images that varied in body fat (high or low) and facial attractiveness (high or low). Contrary to our hypotheses, we found no relationship between participants' state appearance comparisons and change in perceived body size and although participants who made upwards comparisons selected a larger body shape than participants who made downward comparisons, this difference was not significant. As shown in previous research and in line with our hypotheses, participants who made upwards comparisons towards the adaptation images became more dissatisfied and participants who made downwards comparisons did not experience a change of body satisfaction and participants that made upwards comparisons to low body fat adaptors became more dissatisfied with their body. These findings provide preliminary evidence to suggest that perception and attitudes may not be independent of each other and effects on one can alter the other.

Statement of Originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

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Introduction

Body image is a construct that is generally accepted to comprise of perceptual and attitudinal factors (Cash, 2004; Cash, 2012; Cash & Deagle, 1997; Garner & Garfinkel, 1981). Attitudinal body image is concerned with a person's satisfaction with their body and appearance, as well as their thoughts, emotions, and behaviours related to their body. Conversely, perceptual body image is the accuracy with which people perceive their body size (Cash, 2012; Gardner, 1996; Slade, 1994; Tatangelo, McCabe, & Ricciardelli, 2015; Thompson & Berg, 2002).

Understanding body image is important, as there are high levels of body image disturbance present in the population. A study of Australian women found that 86.9% of participants reported being dissatisfied with their weight or shape, and 39.4% of participants reported moderate to marked dissatisfaction (Mond et al., 2013). Other studies in Australia and other countries have shown similar results (Fiske, Fallon, Blissmer, & Redding, 2014; Ricciardelli & McCabe, 2001; Spitzer, Henderson, & Zivian, 1999). Studies investigating body size estimation have found that overestimation is present in the population, although the percentage of the population that does overestimate has yet to be determined (Gardner, 2011; Gardner & Brown, 2014; Guaraldi, Orlandi, Boselli, & Tartoni, 1995). These high rates of body image disturbance are concerning, as dissatisfaction with body image and incorrect estimations of body size are often attributed to the development of anorexia nervosa and bulimia nervosa (Fairburn & Harrison, 2003).

In 2012 it was estimated 914,000 Australians were living with an eating disorder, which equates to approximately 4% of the overall population (Paxton et al., 2012). More concerning is that those with anorexia nervosa and bulimia nervosa are more likely to have died, over a period of approximately 10 years, than the general population (5.86 and 1.93 times, respectively), with suicide being the major cause of death in people with an eating disorder (Arcelus, Mitchell, Wales, & Nielsen, 2011; Pompili, Girardi, Tatarelli, Ruberto, & Tatarelli, 2006). Consequently, it is important for us to carry out research, so that we can better understand what factors affect body image, how they affect it, and how they interact.

Attitudinal Aspects of Body Image

Body dissatisfaction.

Body dissatisfaction is the negative thoughts and beliefs someone has about their weight and shape (Garner, 2002). Body dissatisfaction is more prominent in women, particularly in early adolescence, and can persist into old age (Fallon, Harris, & Johnson, 2014). Yet body dissatisfaction isn't restricted to women in adolescence and adulthood. Body dissatisfaction can occur in children as young as 5, with about 50% of children desiring to be thinner, and some engaging in weight loss behaviours such as exercising and restrictive eating (Davison, Markey, & Birch, 2000; Dion et al., 2016; Lowes & Tiggemann, 2003; Schur, Sanders, & Steiner, 2000). Body dissatisfaction is so common in women that researchers consider dissatisfaction to be normal, a concept known as 'normative discontent' (Cash & Henry, 1995; Rodin, Silberstein, & Striegel-Moore, 1984).

The widespread normalisation of body dissatisfaction is concerning primarily because body dissatisfaction is considered to be the strongest predictor of eating disorder symptomatology in women (Phelps, Johnston, & Augustyniak, 1999; Polivy & Herman, 2002; Stice, Marti, & Durant, 2011; Tylka, 2004). A longitudinal study by Stice et al. (2011) found that adolescent girls in the upper 24% of body dissatisfaction were four times more likely to develop an eating disorder than those in the bottom 76%. Additionally, body dissatisfaction is associated with low self-esteem, depressive symptoms, and suicidal ideation (Duchesne et al., 2017; Holsen, Kraft, & Roysamb, 2001; Kim & Kim, 2009; Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006). Body dissatisfaction is also associated with negative health behaviours, such as substance use, inadequate exercise, risky sexual behaviour, and a lower likelihood of completing breast cancer self-examinations and quitting smoking (King, Matacin, White, & Marcus, 2005; Lepage, Crowther, Harrington, & Engler, 2008; Littleton, Radecki Breitkopf, & Berenson, 2005; Nelson, Lust, Story, & Ehlinger, 2009; Neumark-Sztainer et al., 2006; Ridolfi & Crowther, 2013; Stice & Shaw, 2003). Although there are various factors that increase an individual's risk of becoming dissatisfied with their body, such as gender and age (Fallon et al., 2014), much research has attributed body dissatisfaction to the influence of the media and society.

Body dissatisfaction and the media.

The media is known to propagate the thin ideal in women. A study on Playboy centrefolds from 2000-2014 found that the average model was underweight, according to BMI calculations (Roberts & Muta, 2017). Further, a study by Katzmarzyk and Davis (2001) found that 70% of Playboy centrefolds were underweight. Another study found that just over half of the fashion models that they sampled had a BMI below 18, which is considered underweight (Preti, Usai, Miotto, Petretto, & Masala, 2008). Further, images in the media are often digitally edited, to remove any blemishes, and create an idealistic version of the model (Krawitz, 2014). The fact that models, known for embodying the thin ideal, require digital editing to meet body ideals, is problematic. If meeting body ideals require the use of digital alteration, even in models who epitomise the ideal body shape, women are destined to admire a body ideal that is unrealistic and unobtainable.

Appearance changing strategies are often promoted and advertised in the media (Levine & Murnen, 2009). Dieting is a prominently advertised means of changing one's appearance. Within general women's magazines, one third of all health-related articles were found to relate to dieting (Moyer, Vishnu, & Sonnad, 2001). Problematically, many of the dieting suggestions made by magazines represent popular fad dietary trends and promote quick-fix solutions that are neither realistic nor healthy (Campo & Mastin, 2007; Sarge & Knobloch-Westerwick, 2017). However, being underweight can have negative effects on a person's health. Those that are underweight are more likely to be malnourished, reducing stamina and weakening their immune system (Uzogara, 2016). Being underweight can also result in amenorrhea, infertility, anaemia, and hair loss (Guo & Katta, 2017; Uzogara, 2016). Consequently, it is important that healthy norms and ideals are promoted.

In addition to dieting, cosmetic surgery is another popular choice to change one's appearance to meet beauty standards. An Australian study showed that as television exposure increased, so did participants' endorsement and consideration of cosmetic surgery (Slevec & Tiggemann, 2010). This study suggests that the media and our behaviour towards our body may be linked.

In response to the thin ideal promoted in the media there has been a rise in plus size models, intended to promote a wider range of body types in the media and challenge body norms and ideals. The acceptance of larger body types in the media is thought to reduce dissatisfaction and depression, although research has demonstrated that they result in greater consumption and intention to consume food, as well as lower motivation to change negative lifestyle factors (Lin & McFerran, 2016).

Whilst consumption of traditional print media (i.e. magazines and newspapers) has been steadily declining, their role is being fulfilled by social media applications such as Facebook, Instagram, and Snapchat, where users can share pictures, text, and other content with users (Twenge, Martin, & Spitzberg, 2019). Social media platforms also allow users to edit the content and images they display to present the best version of themselves, a practice that occurs frequently in print media (Fardouly & Vartanian, 2016). Social networking sites are extremely popular with 2.6 billion monthly active Facebook users and 1 billion monthly active Instagram users, equivalent to 33% and 13% of the world's population respectively (Rodriguez, 2019, 2020). These easily accessible resources provide an endless stream of new content that can be accessed at any time. One study of British 14 year olds found that 43% of girls spent 3 or more hours a day on social media (Kelly, Zilanawala, Booker, & Sacker, 2018). Concerningly, the study also found that participants who spent more time on social media experienced more online harassment, poor sleep, low self-esteem and increased body dissatisfaction.

Exposure to images associated with the thin idea have been shown to be associated with increases in body dissatisfaction in correlational studies. Further, experimental studies have established a causal link between the two. Considerable evidence points to social comparison as the mechanism mediating this causal relationship.

Social comparison.

Social comparison theory, first proposed by Festinger (1954), proposes that people experience an innate drive to compare themselves to others, in order to determine their standing. These comparisons can either be towards someone perceived as superior, known as an upward comparison, or towards someone inferior, known as a downward comparison. Downward comparisons have been thought to occur when making an upwards comparison would be detrimental, such as making a person less confident, research has since shown that upwards comparisons are the dominant choice even when there are negative consequences (Festinger, 1954; Gerber, Wheeler, & Suls, 2018; Myers & Crowther, 2009).

Social comparisons are observed for a range of situations from determining one's social status and intelligence, to likelihood of recovering from cancer (Gerber et al., 2018). However, a prominent topic in social comparison literature is its role in how the media affects body satisfaction. Comparisons of attractiveness and body shape are complex and can be both beneficial and detrimental.

The process of making upwards comparisons (i.e. comparisons to someone deemed superior) is well known to have negative effects, particularly on mood and body satisfaction. For instance, studies investigating the effects of making social comparisons towards fashion advertisements on body dissatisfaction and mood found that participants were more dissatisfied and had more negative mood after viewing the images (Tiggemann & Brown, 2018; Tiggemann & Polivy, 2010). Similar effects have been found for Instagram images of attractive peers and celebrities (Brown & Tiggemann, 2016, 2020).

Whilst researchers have attributed changes in body dissatisfaction to the consumption of media images, research has found that the viewing of media images alone does not result in body dissatisfaction. A study by Want and Saiphoo (2017) found that participants asked to remember a complex number while viewing thin bodies did not experience a change in appearance satisfaction, and participants who were asked to remember a simple number experienced a negative change in body satisfaction. This research proposes that social comparisons are cognitively effortful, and when there is not enough cognitive capacity to make social comparisons body satisfaction is unaffected.

Reducing the effects of social comparison.

Problematically, current methods have failed to reduce the negative effects that idealistic images can have on body satisfaction and mood. In 2009, the Australian National Advisory Group on Body Image outlined several strategies for managing negative body image and body dissatisfaction due to media images. One such suggestion was the use of disclaimers in images, where there is a warning on the image to signify the image has been altered, a practice which has since become law in Israel and France (Eggert, 2017; Krawitz, 2014; Tiggemann, Slater, Bury, Hawkins, & Firth, 2013). Research has since found that disclaimers, to warn viewers the image has been retouched, are ineffective at reducing body dissatisfaction and negative affect (Brown & Tiggemann, 2020; McComb & Mills, 2020;

Tiggemann & Brown, 2018; Tiggemann, Brown, & Thomas, 2019; Tiggemann, Brown, Zaccardo, & Thomas, 2017). Research has also trialled the use of disclaimers that give viewers information as to the body size of the model depicted, however results have been mixed (McComb & Mills, 2020). By having disclaimers, it was predicted that consumers would be aware that the image was an unrealistic comparison target and be less likely to make comparisons towards the image, preventing any changes to body satisfaction. Another method intended to reduce body dissatisfaction and negative mood is the removal of “likes” on social media images. In July of 2019 Instagram began trialling the removal of the feature that allows other users to see the number of “likes” an image has (Meisenzahl, 2019). The premise behind the removal of likes is that likes can serve as a way of socially reinforcing the weight and shape ideals displayed in highly liked images. Additionally, it is thought that viewers may make more comparisons towards highly liked images. Although the change was met with positive reviews, research suggests that the number of likes on posts have no effect on body dissatisfaction or appearance comparisons to thin-ideal images (Tiggemann, Hayden, Brown, & Veldhuis, 2018).

In searching for an effective way of reducing body dissatisfaction resulting from exposure to idealistic images, a study by Tiggemann and Velissaris (2020) found that participants’ body dissatisfaction was less affected when the images they viewed had both reality check comments (e.g. “she needs to eat more”) and positive affirmation comments (e.g. “you look so hot here”), rather than only positive affirmation comments. Although the presence of reality check comments did not prevent body dissatisfaction, it highlights the importance of feedback from peers, who are typically the demographic making comments, in determining norms (Tiggemann & Velissaris, 2020). This research suggests that body dissatisfaction caused by idealistic images can be reduced by disapproving comments by peers. These comments may result in an unfavourable perception of the image increasing the likelihood a person makes a downwards comparison to the image.

Upwards comparisons are often associated with negative effects, but under certain circumstances they can be beneficial. Research has found that some women, under certain circumstances, use models as inspirational targets of comparison (Halliwell & Dittmar, 2005; Joshi, Herman, & Polivy, 2004; Mills, Polivy, Herman, & Tiggemann, 2002). A study by Halliwell and Dittmar (2005) found that women told to make self-improvement comparisons towards the images experienced similar amounts of body focused anxiety to those that viewed no models. This suggests that the way a participant frames their comparisons may have an effect on body dissatisfaction. A study by Joshi et al. (2004) found that women trying to lose weight had more positive self-image and social self-esteem after exposure to thin body images than after exposure to control images of products. Consequently, upwards comparisons can be both beneficial and harmful.

Similarly, negative and positive effects have also been reported for downward social comparisons. Although the effects of downwards comparisons to media images have been mixed, much of this is likely to be due to the images not always successfully encouraging downward comparison. Studies have primarily used different body sizes to create upwards and downwards comparisons (Groesz, Levine, & Murnen, 2002; Halliwell & Dittmar, 2005). Problematically, many studies do not measure participants' direction of comparison, preventing inferences being made on how body dissatisfaction is affected by downwards comparisons. However, recent studies have begun to measure direction of comparison, to confirm that the manipulation successfully produced upwards or downwards comparisons. One study found that encouraging participants to make comparisons on appearance and intelligence resulted in upwards and downwards comparisons respectively (Tiggemann & Polivy, 2010). Another study found participants made upwards comparisons to both experimental conditions, a finding that was attributed limitations of the methodology (Fardouly & Rapee, 2019).

Resent research has looked into different types of Instagram images on body dissatisfaction. Positive effects of downward comparisons have been observed in exposure to parody images. A study by Slater, Cole, and Fardouly (2019) used images by the popular Instagram user Celeste Barber, whom recreates popular celebrity pictures, with a humorous flare. These parody images are unglamorous and use Celeste, who doesn't conform to the thin ideal body shape, as the model in the images. Participants who viewed only celebrity images experienced increased body dissatisfaction and more negative mood, participants who viewed only the parody images had increased body satisfaction and more positive mood. Another popular trend on Instagram intended to elicit body positivity is the "Instagram vs reality" post, where two images are presented side by side one that represents the typical Instagram post with digital manipulation, strategic lighting and posing, and the "reality" image which depicts the same image as it would be seen by an observer (Tiggemann & Anderberg, 2019). A study by Tiggemann and Anderberg (2019) found that participants who saw either reality images only or paired ideal and reality images increased their body satisfaction, whilst those that saw the ideal images only became more dissatisfied with their body.

Downward comparisons (i.e. comparisons to someone deemed inferior) may be involved in increasing a person's likelihood of becoming overweight and obese. As more people in your social network or community become obese the more likely you are to become obese (Christakis & Fowler, 2007; Datar, Mahler, & Nicosia, 2020; Datar & Nicosia, 2018). Further, one study found that participants that moved to a community with a higher rate of obesity were more likely to become obese (Datar & Nicosia, 2018). The role of social comparison is unclear in these situations. It is possible that performing more downwards comparisons than upwards comparisons may make people believe they have a better than average body shape and become complacent with their body size resulting in an inability to detect the need for weight loss.

Whilst most of the research has focused on the effects of upwards and downwards comparisons on body dissatisfaction, some studies have also investigated whether the extent to which participants compared themselves affects body dissatisfaction. Research shows that the amount of social comparison mediated the effect of viewing media images on body dissatisfaction, with making comparisons to a greater extent resulting in greater body dissatisfaction (Brown & Tiggemann, 2016, 2020; Tiggemann & Brown, 2018; Tiggemann & McGill, 2004).

Social comparison theory suggests that comparisons will be made more frequently to targets seen as similar to oneself, such as a peer (Festinger, 1954). This phenomenon has been found to occur when making comparisons regarding social or personal factors, such as personality, intelligence, and style, but not when comparing appearance (Brown & Tiggemann, 2016, 2020; Jones, 2001; Strahan, Wilson, Cressman, & Buote, 2006). Further, it was once thought that making comparisons to peers will result in less body dissatisfaction than comparisons to celebrities, as peers have more realistic body shapes to aspire towards (Leahey & Crowther, 2008). However, a meta-analysis by Myers and Crowther (2009) found that comparisons to peers and the media resulted in similar changes of body dissatisfaction, suggesting that both comparisons are detrimental to body satisfaction.

Social comparisons have been found to affect body dissatisfaction, the attitudinal aspect of body image, although research has yet to investigate whether social comparisons can affect the perceptual side of body image.

Perceptual Aspects of Body Image

Body size estimation.

The perceptual aspect of body image is concerned with how accurately people perceive their own body size, a process known as body size estimation (Tatangelo et al., 2015). When someone overestimates or underestimates their body or parts of their body this is known as a perceptual disturbance of body image (Cash & Deagle, 1997). Research into the presence of overestimation has found that it occurs in the general population, however, most research has focused on its prevalence in anorexia nervosa and bulimia nervosa (Gardner, 2011; Gardner & Brown, 2014; Guaraldi et al., 1995). Overestimation in anorexia nervosa and bulimia nervosa has been highly contentious, due to mixed findings. Recent meta analyses suggest that sufferers of anorexia nervosa and bulimia nervosa significantly overestimate their body size, and mixed findings are the result of methodological differences (Farrell, Lee, & Shafran, 2005; Gardner, 2011; Gardner & Brown, 2014; Tovee, Emery, & Cohen-Tovee, 2000). However, studies indicated that underestimation is most likely to occur in those who are satisfied with their body, rather than those dissatisfied with their body (Gardner & Brown, 2014).

Underestimation and overestimation of body size is particularly problematic when considering its relationship with health. Overestimation is associated with higher rates of body dissatisfaction and depression in women, however a causal relationship has yet to be established (Fabian & Thompson, 1989; Gardner, 2011; Grubb, Sellers, & Waligroski, 1993; McCabe, Ricciardelli, Sitaram, & Mikhail, 2006; Taylor & Cooper, 1992; Thompson & Thompson, 1986). Additionally, overestimation is a predictor of treatment failure, lack of progress, early relapse, and poor outcomes in those with eating disorders (Casper, Halmi, Goldberg, Eckert, & Davis, 1979; Garfinkel, Moldofsky, & Garner, 1977; Garner, Garfinkel, & Bonato, 1987; Norris, 1984; Russell, Campbell, & Slade, 1975; Slade & Russell, 1973).

Overweight and obese people that underestimate their size are also less likely to seek help for obesity related medical issues (Powell et al., 2010; Yaemsiri, Slining, & Agarwal, 2011).

While there are various factors that have been correlated or linked with body size misperceptions such as eating disorder pathology, obesity, weight loss, hunger, mood, sexual abuse, and menstrual cycle, much research has focused on the effects of the media (Gardner, 2011; Hamilton & Waller, 1993; Holmstrom, 2004). However, research linking the media to body size estimation does not explain how these changes occur. Researchers have theorised that changes in body size estimation may be due to adaptation effects (Brooks et al., 2020; Challinor et al., 2017).

Adaptation.

The influence of thin ideal images and body shapes in our everyday environment on body size estimation is attributed to a process known as adaptation (Challinor et al., 2017). Adaptation is the process of being exposed to a stimulus for an extended period, resulting in a perceptual aftereffect – a change in the perception of another stimulus. For example, visual adaptation to downward moving lines makes subsequently seen stationary lines appear to move upwards (Addams, 1834). Adaptation research predominantly focuses on visual adaptation, although adaptation effects have been observed in all sensory modalities (Palumbo, D'Ascenzo, & Tommasi, 2017). Visual aftereffects have been observed for various low-level features such as motion, colour, brightness, orientation, and spatial frequency (Webster, 2015). Low-level visual aftereffects are only observed when adaptation (stimulus participants adapt to) and test stimuli (stimuli shown immediately after adaptation) are the same size, location, and orientation on the retina (Webster & MacLeod, 2011). This is because low-level aftereffects are retinotopic. Retinotopy means that there are neurons in the brain that respond to stimuli in small regions of the retina, and any information from adjacent areas of the retina are processed by different neurons (Brooks, Clifford, Stevenson, Mond, &

Stephen, 2018). Therefore, adaptation to low-level stimuli only occurs when the test stimuli and adaptation stimuli are aligned on the retina.

High-level adaptation, unlike low-level adaptation, occurs after adaptation to complex stimuli such as faces, bodies, and environmental and social entities (Greene & Oliva, 2010; Palumbo et al., 2017). High-level adaptation also differs from low-level adaptation in that adaptation effects are not retinotopic (Brooks et al., 2018). Lack of retinotopy means that adaptation and test stimuli can be of different size, orientations, and locations on the retina. This lends to the possibility of adaptation occurring to real world stimuli.

Much of the research on high-level adaptation effects has focused on faces. For example, aftereffects have been observed for adaptation to expanded and contracted facial features, in frontal facing faces (Gwinn & Brooks, 2013; Gwinn & Brooks, 2015a, 2015b; Webster & MacLeod, 2011). After adapting to images where facial features are contracted towards the centre of the face, objectively undistorted faces appear to have facial features expanded away from the centre of the face (Webster & MacLeod, 2011). High-level facial aftereffects have also been produced for elements such as eye gaze, attractiveness, facial expression, age, gender, identity, and ethnicity (Strobach & Carbon, 2013).

Body adaptation.

The finding that adaptation effects occur in faces lead to research into the potential adaptation of body size. Winkler and Rhodes (2005) invited participants to select what they thought was the normal body shape before and after adaptation to either contracted or expanded images of bodies. Winkler and Rhodes found that participants who viewed thinner (larger) adaptation images, selected thinner (larger) bodies to be the most normal after undergoing adaptation, a finding which has been replicated numerous times (Glauert, Rhodes, Byrne, Fink, & Grammer, 2009; Stephen, Hunter, et al., 2018; Sturman, Stephen, Mond, Stevenson, & Brooks, 2017).

The effects are described as overestimations (underestimations) of body size in adaptation literature, while body size estimation studies would describe these as underestimations (overestimations). This confusing difference in the use of terminology is because adaptation terminology originates from low level aftereffects. In low level adaptation participants would report experiencing an adaptation effect in the opposite direction to the stimulus they adapted to, as shown in the example where visual adaptation to downward moving lines makes subsequently seen stationary lines appear to move upwards (Addams, 1834). Although participants who adapt to high level stimuli report their point of subjective normality (PSN: the stimulus size that appeared normal) further towards the direction of the adaptation stimuli, when shown a single test stimulus after adaptation, they report the image as being in the opposite direction to the stimulus they adapted to. For example, adaptation to thinner bodies would result in participants selecting a thinner body as the most normal, but when shown an image representative of their baseline perception of normal, participants will report the image as being larger than their perception of normal. Consequently, this type of adaptation effect is defined as an overestimation of body size. Body adaptation effects such as these have major implications for the way the media and the community around us may affect our perceptions of body size.

Body adaptation in the real world.

Research into body adaptation has yet to confirm that adaptation to stimuli outside the laboratory directly impacts perceptions of body size, however, there is building evidence to suggest that this may be the case. Firstly, studies have established that body adaptation effects transfer across identities, meaning that adaptation to an unknown participant can alter perceptions of another unknown participant or even your own body shape (Brooks, Mond, Stevenson, & Stephen, 2016; Hummel, Rudolf, Untch, Grabhorn, & Mohr, 2012). Secondly, a study by Sekunova, Black, Parkinson, and Barton (2013) found that adaptation effects occurred when the adaptation and test stimuli were facing different directions. They also found that poses that did not obscure the body size of the adaptation stimuli resulted in an adaptation effect. Although this evidence suggests that adaptation to stimuli in the media and the community may be possible, further research is needed.

Further, in order for body adaptation to have a lasting effect on people's perception, research needs to show that participants experience an altered perception long after adaptation. Research into higher level adaptation such as face adaptation has found that adaptation of less than half an hour can produce an aftereffect that is still present more than a week after exposure (Carbon & Ditye, 2012). Other studies have also found adaptation effects to last four times as long as the adaptation duration (Burton, Jeffery, Bonner, & Rhodes, 2016; Kloth & Schweinberger, 2008). It should be noted that real-world exposure to potential body adaptation stimuli (e.g. through watching television, browsing social media, or visiting family or friends) is likely to be frequent and for long durations.

Body adaptation and perception of self.

As previously mentioned, adaptation can change perceptions of our own body shape. Changes to perceptions of own body shape after adaptation follow the same trends as changes to the normal body shape. Participants perceive a smaller body shape to be their accurate body shape after adaptation to low body fat images (i.e. thinner), and they perceive a larger body shape to be more accurate after adaptation to high body fat images (i.e. larger) (Brooks et al., 2016; Hummel, Grabhorn, & Mohr, 2012; Hummel, Rudolf, et al., 2012; Mohr, Rickmeyer, Hummel, Ernst, & Grabhorn, 2016). While the change in perception of own body size may at first seem counterintuitive, if participants were to view themselves in a mirror immediately after adaptation to low body fat (or high body fat) images they would perceive themselves as larger (or skinnier) than they really are.

However, the effect of adaptation in anorexia nervosa and bulimia nervosa is less clear. A study by Mohr et al. (2016) found that unlike healthy controls, adaptation to pictures of thinner versions of themselves did not change eating disordered participants' perception of own body size. The stronger the eating disordered participant's body image distortions, measured using various questionnaires, the smaller the adaptation effect. Mohr et al. suggested that a lack of aftereffect may be due to eating disordered patients being pre-adapted to thin images through everyday consumption of similar images. This theory is supported by evidence that body dissatisfaction was related to the duration spent attending to thin body shapes, with those more dissatisfied likely to attend to thin images more frequently and for longer (Cho & Lee, 2013; Glauert, Rhodes, Fink, & Grammer, 2010; Stephen, Sturman, Stevenson, Mond, & Brooks, 2018). It is possible that adaptation to thin images, caused by everyday exposure, has resulted in a ceiling effect where no further adaptation can be demonstrated.

Mohr et al.'s (2016) theory could explain the lack of adaptation to thin images for eating disordered participants in their experimental study, however, the theory contradicts body size overestimation in those with eating disorders. If adaptation was purely responsible for changes in perceived size of self in anorexia nervosa, we would expect to see anorexia nervosa patients overestimate their body size due to longstanding adaptation to thin media images. Rather, the opposite effect is observed in body size estimation research, where anorexia nervosa patients tend to select images of their bodies that have been digitally altered to appear larger as most accurate, indicating, as described in body size estimation research, an overestimation (see section on Body adaptation, p. 13, for further clarification) of their body size (Farrell et al., 2005; Gardner & Brown, 2014).

Research has found that the overestimation of body size in anorexia nervosa is due to attitudinal body image affecting body size estimation. Cornelissen, Johns, and Tovee (2013) found a complex interaction between body size estimation, weight and shape concern, and depression and self-esteem. They found that those who scored low either for weight and shape concern or for depression and poor self-esteem were more likely to underestimate their size, while participants with high scores for these variables were more likely to overestimate their size. Further, they found that high scores for weight and shape concern could be offset by low scores on depression and poor self-esteem, and vice versa, leading to more accurate perceptions of body size. The suggestion that attitudes affect perceptions of self has been proposed in other research (Gardner & Bokenkamp, 1996; Smeets, Ingleby, Hoek, & Panhuysen, 1999).

More recently, support for attitudes impacting perceptions of body size comes from a study by Gledhill, George, and Tovee (2019). They found that participants with anorexia nervosa and healthy controls performed similarly in their classification of other women's body size, suggesting that anorexics do not experience an error in the way they perceive all body shapes. Consequently, it is likely that misperceptions of own body size experienced by anorexics are likely due to their attitudes towards their own body rather than their perception of their body. We suggest that if attitudes are able to influence perceptions of our own body size, perhaps social comparisons, the method by which images impact our attitudes, can affect the change in perceived body size.

Research Aims and Hypotheses

This research combines two prominent areas of body image research, social comparison and body adaptation, as outlined above. This research will expose participants to stimuli depicting individuals that vary by facial attractiveness (high and low facial attractiveness), to encourage upwards or downwards comparisons, and body size (high and low body fat), to measure the effect of body adaptation.

Manipulation of facial attractiveness has been previously shown to significantly alter perceived attractiveness of an image of a whole female body (Vermeir & Van de Sompel, 2013). Further research into overall attractiveness has found that facial attractiveness predicts overall attractiveness more strongly than body attractiveness. However, this difference was only significant for images of men (Brown, Cash, & Noles, 1986; Peters, Rhodes, & Simmons, 2007). One study by Riggio, Widaman, Tucker, and Salinas (1991) found that facial attractiveness and dynamic components of attractiveness (expression, communication, and presentation) were the strongest predictors of overall attractiveness, and body attractiveness and dress did not significantly affect overall attractiveness. By manipulating facial attractiveness and body size independently we are able to determine how facial attractiveness affects changes in body dissatisfaction and perceived size.

Studies investigating the effect of viewing bodies of different sizes on body dissatisfaction are particularly important for understanding the negative effects the media has on body satisfaction, as well as finding ways to reduce body dissatisfaction. There have been promising studies that have found that participants who viewed average sized models had significantly lower levels of body dissatisfaction and body focused anxiety than those that saw control images (Diedrichs & Lee, 2011; Halliwell, Dittmar, & Howe, 2005). Although not all studies have found that viewing average or oversized bodies resulted in an increase in body satisfaction (Lin & Kulik, 2002). One possible reason that there is varied effectiveness of showing realistic body shapes, is that facial attractiveness is important for determining overall attractiveness, and may, therefore, affect the direction of comparison and how much a participant's body satisfaction is changed.

This research will improve on previous research by investigating how facial attractiveness affects body dissatisfaction. Importantly, by controlling body size, this research will be able to distinguish how much the change in body dissatisfaction is due to the facial attractiveness of the experimental stimuli. The following hypothesis is proposed:

H1: Viewing stimuli with high attractiveness faces will result in participants becoming more dissatisfied with their body, whilst viewing stimuli with low attractiveness faces is predicted not to significantly change body satisfaction.

Previous studies into social comparison and body satisfaction have also investigated the effect of state appearance comparisons on the change in body satisfaction. State appearance comparison is a measure of the extent to which participants compared themselves to the adaptation images in a particular situation. This measure is concerned with the extent of comparison and not the direction of comparison. For participants making upwards comparisons the more they compared themselves to the images, the more dissatisfied they became (Brown & Tiggemann, 2016, 2020). One study by Tiggemann and Anderberg (2019) has investigated the relationship between state appearance comparisons and body dissatisfaction for downward comparisons, and found no effect. However, their study inferred the direction of comparison by image type and did not measure whether the experimental images successfully encouraged upwards and downwards comparisons. By measuring the direction of comparison in this study we can determine if a lack of a relationship between body satisfaction and the extent to which participants compared themselves is due to limitations of the stimuli used. The following hypothesis is proposed:

H2: Participants who made state appearance comparisons to a greater extent are predicted to have a larger change in body satisfaction than participants who made state appearance comparisons to a lesser extent.

Although research has previously investigated the effect of upwards and downwards comparisons on body dissatisfaction, no research has been conducted to investigate the effects of social comparisons on body adaptation effects. Although there has been ample research into the effects of viewing body stimuli on body size estimation and body dissatisfaction (Groesz et al., 2002; Hamilton & Waller, 1993; Myers & Biocca, 1992; Myers & Crowther, 2009), the underlying processes of adaptation and social comparison thought to cause these changes in body image have been investigated separately. One possible reason for the lack of research combining body adaptation and social comparison is due to the stimuli used to measure outcomes.

Firstly, we wanted to confirm previous research into the effects of adaptation on perceptions of own body size images (Brooks et al., 2016; Hummel, Grabhorn, et al., 2012; Hummel, Rudolf, et al., 2012; Mohr et al., 2016). The following hypothesis was proposed:

H3: Viewing thin (fat) bodies during adaptation will result in participants selecting a thinner (fatter) body as their perceived body size post-adaptation, than pre-adaptation.

Body adaptation studies use various extreme body shapes to produce adaptation effects. Similarly, social comparison research often uses body shape to manipulate the direction of social comparison. The use of the same manipulation to measure different effects prevents researchers from distinguishing if social comparisons affect body aftereffects. Although self-report measures of body dissatisfaction can be used to determine whether appearance comparisons were primarily upwards or downwards comparisons, studies that use self-report measures without any manipulation will find participants make primarily upwards comparisons for low body fat images and downwards comparisons for high body fat images, as has been shown in previous social comparisons studies (Tiggemann & Polivy, 2010). Consequently, in order to encourage upwards and downwards comparisons for each body size, we manipulated the facial attractiveness of the stimuli. The following hypothesis was proposed:

H4: Face attractiveness will affect the magnitude of participants' change in perception. Specifically, adaptation to images with high attractiveness faces will lead participants to select a larger body shape than participants adapting to stimuli with low attractiveness faces. See Figure 1 for a graphical representation of the predicted results.

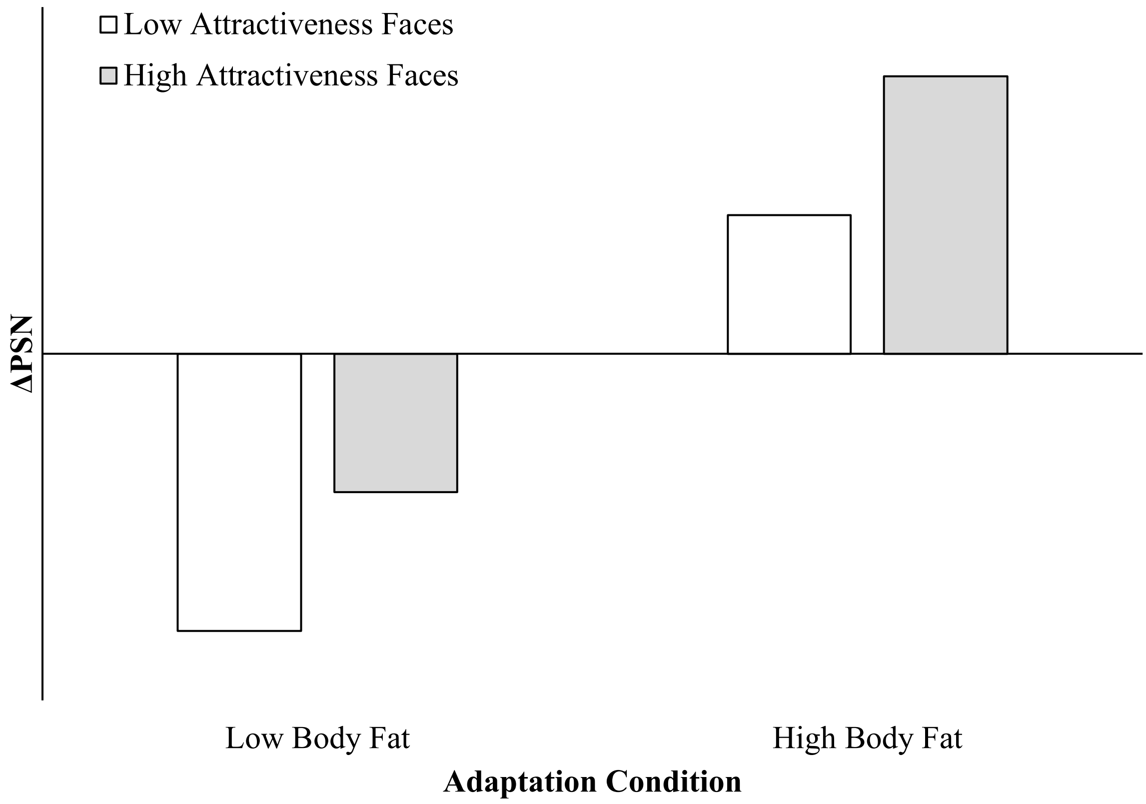

Figure 1. Prospective results for change in PSN for all adaptation conditions.

Additionally, we also wanted to investigate the relationship between state appearance comparison and the size of the adaptation effect. A study by Rhodes et al. (2011) found that active attention towards adaptation stimuli resulted in greater face adaptation effects than passively viewing face stimuli. Although this study was done on face aftereffects, a similar effect might occur in state appearance comparisons, where participants who make social comparisons, which requires cognitive effort (Want & Saiphoo, 2017), to a greater extent experience a larger adaptation effect. The following hypothesis is proposed:

H5: Participants who make state appearance comparisons to a greater extent are predicted to have a larger adaptation effect than participants who made state appearance comparisons to a lesser extent.

This research will expose participants to stimuli that vary by facial attractiveness (high and low facial attractiveness), to encourage upwards or downwards comparisons. To assess the effectiveness of the manipulation we will assess participants self-reported direction of comparison towards the stimuli. If the manipulation is unsuccessful in influencing the direction of social comparison, self-reported direction of comparison can be used in the analyses.

Methods

Participants

Eighty-seven female participants were recruited from the Macquarie University undergraduate psychology participant pool, Macquarie University paid participant pool, or were friends or family of the researcher. Participants recruited from the psychology participant pool received course credit. Participants recruited from the paid participant pool or friends and family of the experimenter received $20 for their participation. The eligibility criteria to participate in the experiment was advertised as Caucasian females aged 18 to 35. Two participants were removed due to age restrictions (18-35 years). Four participants were removed due to errors in the experimental procedure. One participant was removed due to lack of compliance with the experimental instructions. After the outbreak of the coronavirus pandemic in March 2020, participant recruitment ended prematurely as ordered by the Vice Chancellor of Macquarie University. Consequently, an additional thirteen participants were excluded as they were unable to complete the entire experiment. Further, participants who did not meet the eligibility criteria due to ethnicity were included in the analysis to avoid any further loss of data.

Sixty-seven participants remained in the final sample (Mean age = 20.49, SD = 3.377). Of the remaining participants 92.5% identified as Caucasian, 3% as middle eastern, 1.5% as Asian, and 3% as “other”. One participant selected two ethnicities, as one of their ethnicities met the inclusion criteria their second selection was ignored for the purpose of data analysis.

This research was approved by the Macquarie University Human Research Ethics Committee (see Appendix). All participants gave prior consent in writing and were given the opportunity to withdraw their data at the conclusion of the study.

Power

An a priori power analysis was conducted using G*Power3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) for the hypotheses which required the largest number of participants. To test whether the extent to which participants compared themselves affected the change in PSN, for a medium to large effect size ($f = .20$) and an alpha of .05, a total sample of 199 participants was required to achieve a power of .80. Thus, our proposed sample size of 200 would be enough. However, due to the outbreak of coronavirus a total sample size of sixty-seven was collected. Using the same effect size and alpha, the sample resulted in a power of 0.36 for the two analyses.

Design

The experiment used a 2 x 2 between-subjects design with two independent variables. The first independent variable was the body fat of the adaptation stimuli, which was either high or low. By manipulating the body fat of the adaptation stimuli, it was expected that perceptions of own body size would change, as has been shown in other research (Brooks et al., 2016; Hummel, Rudolf, et al., 2012). The second independent variable was the facial attractiveness of the adaptation stimuli, which was either high or low. By manipulating facial attractiveness, we aimed to encourage participants to make upwards comparisons (high attractiveness faces) or downward comparisons (low attractiveness faces).

All dependent variables measured the change in the participants response before and after viewing adaptation stimuli. The first dependent variable was the change in body satisfaction. The second dependent variable was the change in the PSN of the participant's own body, measured by the difference between the body fat levels of the images selected in the pre- and post-adaptation tasks.

Stimuli

All stimuli were presented on a 24-inch desktop monitor with a resolution of 1920x1200 pixels, using Matlab R2019a. Participants were seated approximately 60 cm away from the monitor.

Adaptation stimuli.

Adaptation stimuli consisted of four different image banks: high attractiveness faces with low fat bodies, low attractiveness faces with low fat bodies, high attractiveness faces with high fat bodies, and low attractiveness faces with high fat bodies. These four image banks were developed by superimposing faces onto bodies using Adobe Photoshop.

To create the variation in facial attractiveness, previously collected data on facial attractiveness was analysed to determine which faces, from an existing image library, had the highest and lowest scores on attractiveness (Hsieh et al., 2019). Faces with apparent ethnicities other than Caucasian and any outliers in skin tone (such that realistic Photoshop blending might prove problematic) were removed. The five faces ranked highest and lowest on attractiveness were used as the faces of the adaptation stimuli.

To create the variation in body size of the adaptation stimuli, 5 images of different women from the Macquarie University database of body stimuli were selected. The 5 images selected have previously been used in other studies as adaptation stimuli and were selected from the image library for being closest to average for body fat, muscle mass, and height. The 5 images had previously been morphed into high and low body fat versions of the same image using the program Psychomorph (Tiddeman, Burt, & Perrett, 2001). To create these high and low body fat versions, photographs of 10 women who had the highest and 10 women with lowest body fat mass scores (controlling for muscle mass and height) were selected, and delineated to create an outline of each body which was then averaged to create a template of the body shapes. These templates were then used to digitally warp the images of the average participants, and keep them in proportion, to create the 5 low body fat and 5 high body fat images (see Stephen, Sturman, et al. (2018) for more detail). The apparent difference between each set of low and high body fat images was 12 kg of fat.

To combine the bodies and the faces, using Photoshop, every high attractiveness face was paired with a low attractiveness face, based on similarity in skin tone. The faces were edited to remove their background and necks, to allow for better blending of skin tone. Each face was then superimposed onto a high and low body fat version of the same identity, with the size of the eyes and jaw of the underlying face (which was later edited out) used to guide the appropriate size of the overlayed face. Each overlayed face maintained the same size in the high and low body fat versions, and the chin height of each pair of high and low attractiveness faces was closely matched. The skin tones of the high and low body fat images were adjusted equally in Photoshop to match the skin tone of the faces. See Figure 2 for an example not used in the experiment. This resulted in 4 different images for each original adaptation identity, each image had either high or low body fat and high or low facial attractiveness. See Figure 3 for a visual demonstration. All images were then cropped to the same size and resized to 720 by 1080 px. The images were cropped below the knee to ensure that the participants could easily see the faces of the adaptation stimuli. Overall, twenty images were created, with five images for every adaptation condition.

Figure 2. Example stimulus not used in the experiment. This example is being used to demonstrate the quality of the superimposing of the face on the body.

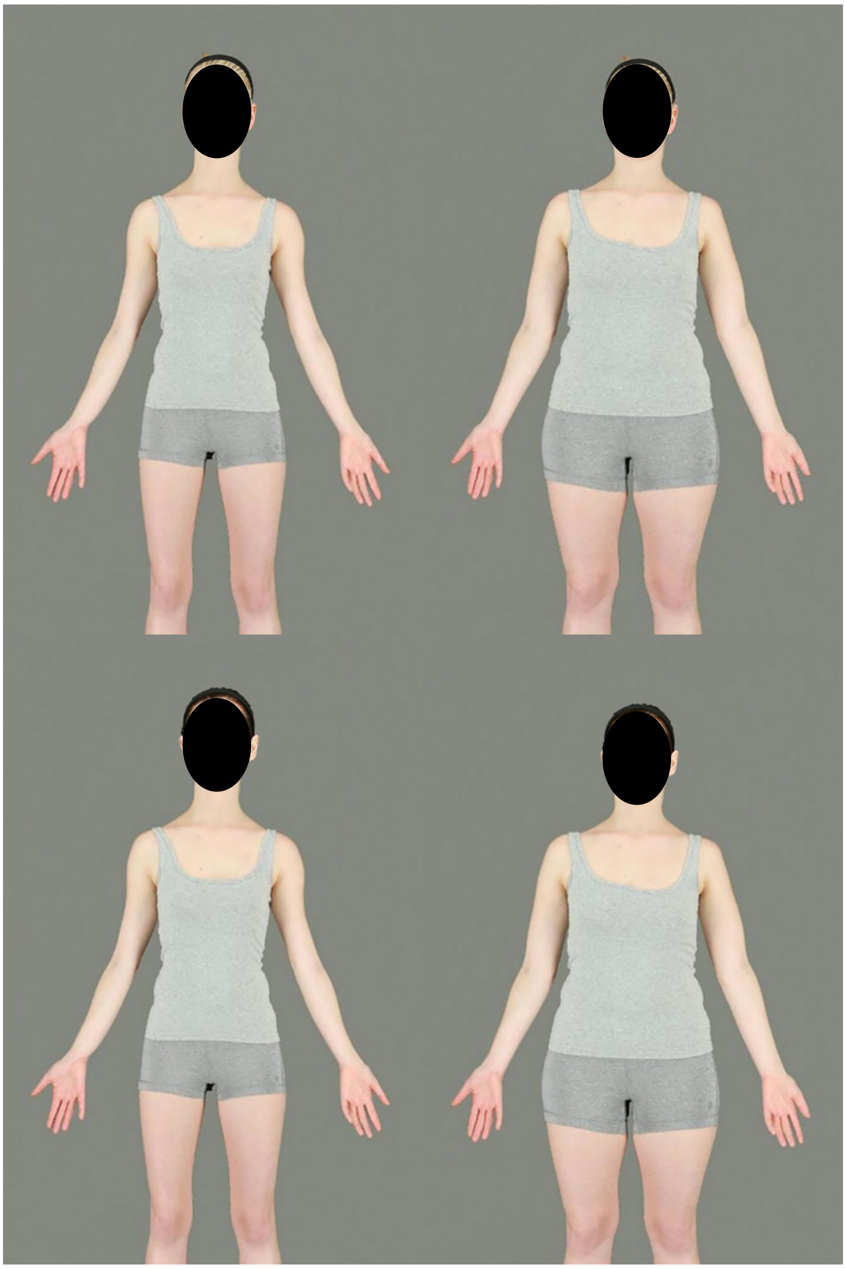

Figure 3. Example stimuli for the same original identity. The left column is the low body fat conditions, the right column is the high body fat conditions. The top row is the high attractiveness faces, and the bottom row is the low attractiveness faces. Faces have been obscured in the images for ethical reasons but were fully visible to participants in the experiment.

Test stimuli.

Test stimuli were created using images of the participant. Each participant attended a session between 1-14 days prior to the experiment, where they read and signed the consent form, completed the demographic survey and had their photograph taken.

At the photography session participants wore a standard tightly fitting grey singlet and shorts. Participants posed in a standard anatomical position facing forward, inside a light booth painted Munsell N5 neutral gray and illuminated with 15 fluorescent lights. Additional images were taken for use in future studies but were not used in this experiment. Photographs were taken using a Canon D50 digital SLR camera with all settings held constant.

The photos were transformed using Psychomorph in the same way as the adaptation stimuli (see Stephen, Sturman, et al. (2018) for more detail). Participants' faces were not transformed during this process and were visible throughout the experiment. The program manipulated the images in 13 equidistant steps, with the middle image corresponding to the original photograph. These images were used to create a method of adjustment task where participants were able to move a computer mouse right and left, across a screen, to increase and decrease the size of the participant's body, respectively. Only one image of the participant was shown at a time, in the centre of the screen. As the participant moved the mouse the image transitioned into the next body size and stopped changing when the participant reached the extremity of the body transformations. The cursor was not visible during this process. All images were full body images measuring 600 by 900 px.

Measures

Demographic survey.

Participants were asked to complete a demographic survey on paper. The survey consisted of four basic demographic questions and was used to confirm that the participant was eligible to participate in the research.

The Body Image States Scale (BISS).

The BISS (Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002) consists of six items (three negatively scored) designed to measure a participant's body dissatisfaction at the present moment. As this study required repeated measurement of body satisfaction within a short time period, a modified version of the BISS was used (Bell, Lawton, & Dittmar, 2007). In this version, the original 9-point Likert scale was replaced by a visual analogue scale (VAS) to reduce the potential of memory to reduce the scale's sensitivity to detect changes over a short time span. The scale comprised questions such as 'Right now I feel… with my physical appearance', where participants were able to respond to the prompt by intersecting a 9cm line anchored with 'extremely dissatisfied' and 'extremely satisfied', for example. In the present study, the adapted version of the BISS had high internal reliability in the pre- (α = .738) and post-adaptation conditions (α = .861). In comparison, the original scale had a coefficient of α = .77 (Cash et al., 2002). Higher scores on the BISS indicate more positive body satisfaction.

State Appearance Comparison Scale (SACS).

After the main part of the experiment, participants completed a modified version of the SACS (Tiggemann & McGill, 2004) to measure the extent to which participants made comparisons towards the adaptation images in general. Using a 7-point Likert scale participants rated the extent to which they thought about their appearance when viewing the images (1 = no thought about my appearance, 7 = a lot of thought); the extent to which they compared their overall appearance to the women in the images (1 = no comparison, 7 = a lot of comparison); the extent to which they compared their weight and shape to the women in the images (1 = no comparison, 7 = a lot of comparison); and the extent to which they compared their facial attractiveness to the women in the images (1 = no comparison, 7 = a lot of comparison). The items were averaged to form an overall score. Internal reliability of the measure was high ($\alpha = .743$).

Direction of social comparison.

After the main part of the experiment, participants rated whether they thought the women in the images were more or less attractive than them, whether they thought the faces of the women in the images were more or less attractive than them, and whether they thought the weight and shape of the women in the images were more or less attractive than them, using a 5-point Likert scale (1 = much less attractive, 5 = much more attractive). These items were used independently to determine whether the participants made upwards or downwards comparisons towards the face, body, and overall attractiveness of the adaptation images in general.

Procedure

Prior to starting the experiment participants completed the BISS. The experiment consisted of a practice phase, pre-adaptation phase, adaptation phase, and a post-adaptation phase.

During the practice phase, participants were instructed to move the mouse right and left to change the image on the screen and click the screen when the image matched their current body shape. Participants completed 2 practice trials. The body fat level that appeared first on the screen was randomised for every trial throughout the experiment. The following pre-adaptation phase was similar to the practice phase, however, participants completed 10 adjustments of the test stimuli.

During the adaptation phase, participants viewed images from one of the 4 experimental groups for 5 minutes (high attractiveness face with low body fat, low attractiveness face with low body fat, high attractiveness face with high body fat, and low attractiveness face with high body fat). In this time, 5 different stimuli each appeared on the screen four times for 15 seconds each time, in a pseudo-randomised order, such that the same stimuli did not appear twice in a row. By analysing studies collected in a meta-analysis by Myers and Crowther (2009) we determined that each image would be shown for 15 seconds at a time, as this time has shown to be sufficient for participants to make social comparisons.

In the post-adaptation phase participants completed the same method of adjustment task as in the pre-adaptation phase, however, between each adjustment a randomly selected adaptation image was displayed for 15 seconds, as 'top up' adaptation, to maintain the levels of adaptation throughout this experimental phase. In keeping with previous body adaptation studies, we maintained the adaptation to top-up timing ratio of 20:1 (Brooks et al., 2016; Sturman et al., 2017).

At the end of the experiment, participants completed the SACS, the scale to measure direction of social comparison, and the BISS. Finally, participants were debriefed on the purpose of the experiment and were given the opportunity to withdraw their data if they chose to do so. No participant requested that their data be removed.

Results

Variables

The two dependent variables discussed in the results section are the change in the score on the Body Image States Scale (ΔBISS), and the change in the point of subjective normality (ΔPSN). A positive ΔBISS indicates that the participant is more satisfied with their body after adaptation when compared to baseline. While a negative ΔBISS indicates a participant is more dissatisfied with their body after adaptation when compared to baseline.

For ΔPSN, a positive ΔPSN indicates that the participant chose a higher body fat version of themself after adaptation when compared to baseline. A negative ΔPSN indicates that the participant chose a lower body fat version of themself after adaptation when compared to baseline.

All data sets met the assumptions of the statistical test unless otherwise specified. Additionally, the alpha level for multiple comparisons was determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995). This method controls for false discovery rate and is less strict, as it increases power. It is widely used in studies where a large number of hypotheses are tested, where other corrections, such as a Bonferroni adjustment, would result in inadequate power to detect any significant effect (Chen, Feng, & Yi, 2017). Consequently, as my study lacked power this adjustment was deemed the most appropriate.

Baseline data

Baseline descriptive statistics are shown in Table 1. Baseline PSN scores indicated that 59.7% of participants chose, on average, images that had lower body fat than the real image of themselves, 6.0% chose images that were accurate, and 34.3% chose images that had higher body fat than the real image of themselves. Unlike previous body estimation studies we compared participants perceived body size to their actual body size and found that overall participants chose a significantly lower body fat image of themselves to be most accurate, (M = 5.54, SD = 1.39, a score of 6 denotes their actual body shape), as shown by a one-sample t-test, 95% CI [-0.80, -0.12], $t(66) = -2.72$, $p = .008$, $d = -0.33$.

Table 1

Baseline Descriptive Statistics

	Mean	SD
Age	20.49	3.38
BMI	22.19	3.97
BISS	4.94	1.16
PSN	5.54	1.39

Note. BMI = Body Mass Index; BISS = Body Image States Scale; PSN = Point of Subjective Normality.

Exploratory analysis revealed that baseline PSN scores were significantly correlated with baseline BISS score, $r_s(65) = -.30$, $p = .013$, indicating that participants who were more dissatisfied with their body had a larger PSN. The alpha level for this analysis was set at .017 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995). Additional exploratory analyses provided non-significant correlations for BMI and baseline PSN, $r_s(65) = .22$, $p = .073$, and BMI and baseline BISS, $r_s(65) = -.16$, $p = .194$.

Multiple two-way ANOVAs were conducted to determine if there were any significant differences in baseline data across the conditions. Results indicated that the four adaptation conditions were not significantly different in terms of their pre-adaptation PSN, $F(1,63) = 0.02$, $p = .879$, $\eta_p^2 = .000$, baseline BISS score, $F(1,63) = 0.00$, $p = .978$, $\eta_p^2 = .00$, or BMI, $F(1,63) = 0.16$, $p = .692$, $\eta_p^2 = .00$.

Manipulation check

Within each body size adaptation condition, the facial attractiveness of the stimuli was manipulated to encourage upward or downward social comparisons. Frequency statistics shown in Table 2 indicate that not all participants made comparisons in the desired direction. An analysis was conducted to determine the effectiveness of this manipulation.

Table 2

Direction of Comparison to the Adaptation Images

Body Fat	Facial Attractiveness	Direction of Comparison	Facial Attractiveness		Weight and Shape		Overall Attractiveness	
			Frequency	Percent	Frequency	Percent	Frequency	Percent
Low	Low	Downward	6	40	3	20	3	20
		Same	5	33.3	4	26.7	4	26.7
		Upward	4	26.7	8	53.3	8	53.3
	High	Downward	0	0	0	0	0	0
		Same	4	23.5	6	35.3	4	23.5
		Upward	13	76.5	11	64.7	13	76.5
High	Low	Downward	4	23.5	6	35.3	4	23.5
		Same	3	21.4	3	21.4	3	21.4
		Upwards	3	21.4	7	50	3	21.4
	High	Downward	0	0	0	0	0	0
		Same	7	33.3	10	47.6	4	19
		Upward	14	66.7	11	52.4	17	81

A low score on self-reported direction of social comparison with the images indicated that the participant made a downward comparison, a high score indicated upwards comparisons, and a score of 3 represented neither upwards nor downward comparisons. Figure 4 shows the mean score for direction of comparison for (a) facial attractiveness, (b) weight and shape attractiveness, and (c) overall attractiveness.

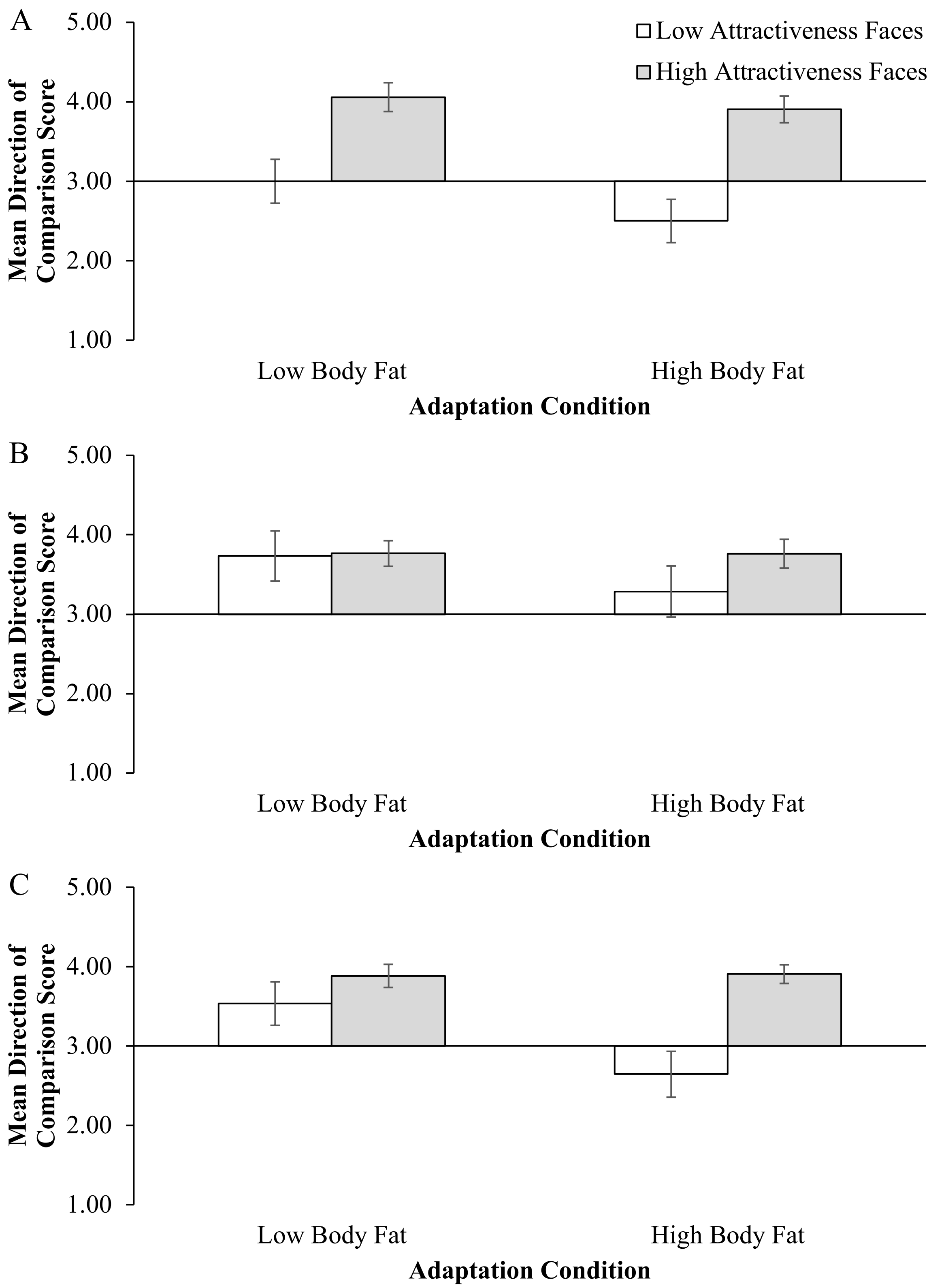

Figure 4. Mean direction of comparison score for each adaptation condition. Error bars represent ±1 SEM. (a) facial attractiveness, (b) weight and shape attractiveness, and (c) overall attractiveness.

As direction of facial/body/overall comparison scores were not normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$), two Mann-Whitney U tests were run, for every type of comparison, to determine if there was a difference in comparison direction between high and low attractiveness faces, split by body size.

Distributions of the direction of comparison participants made towards low and high attractiveness faces were not similar for high and low body fat adaptation conditions, as assessed by visual inspection. Mann-Whitney U-tests showed a statistically significant difference in the direction of facial comparisons between participants who viewed stimuli with low attractiveness faces (mean rank = 10.71) and stimuli with high attractiveness faces (mean rank = 22.86) in the high body fat condition, $U = 249$, $z = 3.563$, $p < .001$, and between stimuli with low attractiveness faces (mean rank = 11.67) and stimuli with high attractiveness faces (mean rank = 20.76) in the low body fat condition, $U = 200$, $z = 2.837$, $p = .005$.

Analyses were conducted to determine the direction of comparison participants made to the weight and shape of the adaptation stimuli. Distribution of the direction of comparison participants made towards low and high attractiveness faces were not similar for high and low body fat adaptation conditions, as assessed by visual inspection. Mann-Whitney U-tests showed a non-significant difference in the direction of weight and shape comparisons between participants who viewed stimuli with low attractiveness faces (mean rank = 15.86) and stimuli with high attractiveness faces (mean rank = 19.43) in the high body fat condition, $U = 177$, $z = 1.059$, $p = .290$, and between stimuli with low attractiveness faces (mean rank = 16.60) and stimuli with high attractiveness faces (mean rank = 16.41) in the low body fat condition, $U = 126$, $z = -0.059$, $p = .953$.

Further analyses were conducted to determine the direction of comparison participants made to the overall images. Distributions of the direction of comparison participants made towards stimuli with low and high attractiveness faces were not similar for high and low body fat adaptation conditions, as assessed by visual inspection. Mann-Whitney U-tests showed a statistically significant difference in the direction of overall comparisons between participants who were adapted to stimuli with low attractiveness faces (mean rank = 11.00) and stimuli with high attractiveness faces (mean rank = 22.67) in the high body fat condition, $U = 245$, $z = 3.539$, $p < .001$. However, there was non-significant difference between stimuli with low attractiveness faces (mean rank = 14.90) and stimuli with high attractiveness faces (mean rank = 17.91) in the low body fat condition, $U = 151$, $z = 0.980$, $p = .327$. These results indicated that we successfully encouraged more upwards comparisons towards the overall appearance of stimuli with high attractiveness faces than those with low attractiveness faces, in the high body fat adaptation conditions. However, we were not successful in encouraging more upwards comparisons towards the overall appearance of stimuli with high attractiveness faces than stimuli with low attractiveness faces, in the low body fat adaptation conditions. Consequently, our manipulation was only partially successful.

Body Satisfaction

Hypothesis 1: Effect of direction of comparison on body satisfaction.

To test whether viewing stimuli with high attractiveness faces resulted in participants becoming more dissatisfied with their body and viewing stimuli with low attractiveness faces resulted in a non-significant ΔBISS, a one-sample t-tests was run for each of the four adaptation conditions. The change in body dissatisfaction for each experimental condition is plotted in Figure 5. As adjusting the facial attractiveness of the adaptation stimuli was only partially successful in altering direction of comparison towards the adaptation images overall, all groups except participants in the low attractiveness faces with high body fat adaptation condition, made upwards comparisons.

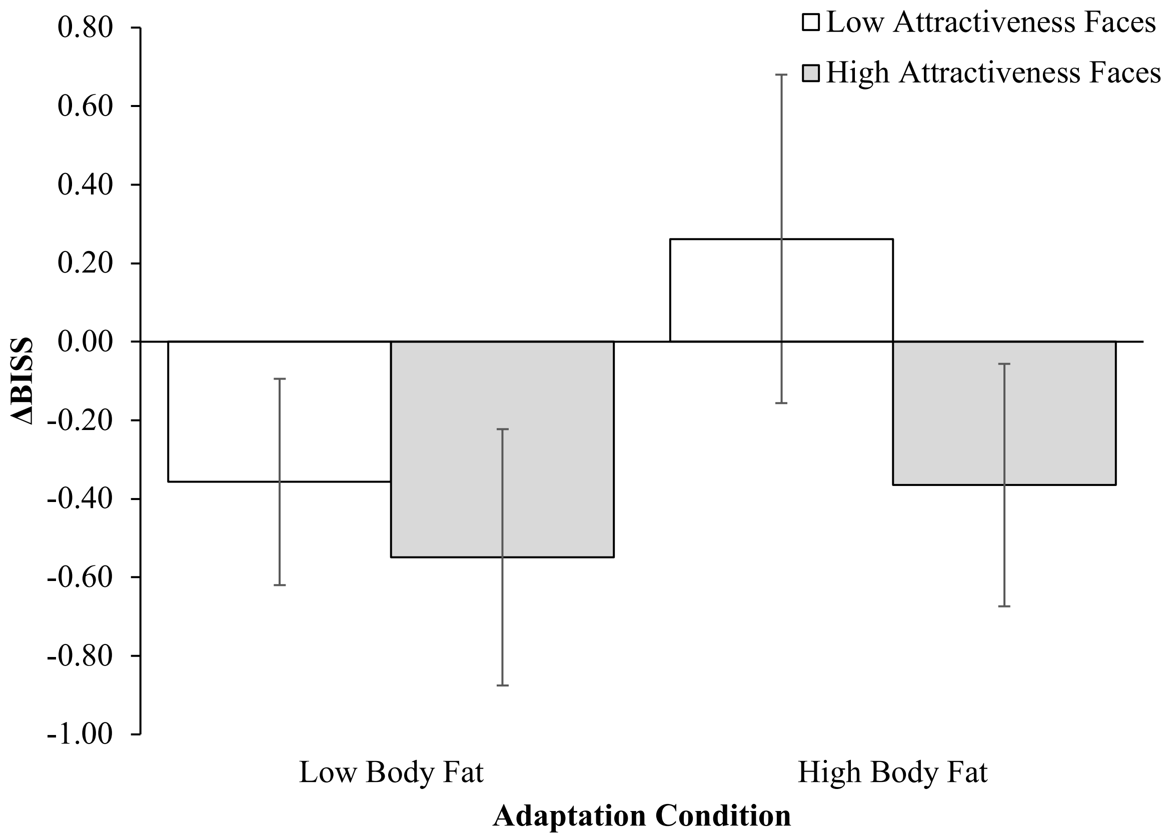

Figure 5. Mean change in body image states scale score (ΔBISS), for all adaptation conditions. Error bars represent 95% Confidence Intervals. A negative ΔBISS indicates participants became more dissatisfied with their body, and a positive ΔBISS indicates participants became more satisfied with their body.

There was one outlier in the low attractiveness low body fat adaptation group, as assessed with studentized residuals greater than ±3 standard deviations. The scores for the low facial attractiveness low body fat adaptation group were also not normally distributed, as assessed by Shapiro-Wilk's test, p = .013. All adaptation groups were normally distributed after the removal of the outlier.

The alpha level for this analysis was set at .0375 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995). In line with our hypothesis, there was a statistically significant decrease in BISS after adaptation to high body fat stimuli with high attractiveness faces, M = -0.37, SD = 0.69, 95% CI [-0.68, -0.05], $t(20)$ = -2.44, p = .024, d =

-0.53, low body fat stimuli with low attractiveness faces, $M = -0.36$, $SD = 0.50$, 95% CI [-0.65, -0.07], $t(13) = -2.66$, $p = .019$, $d = -0.71$, and low body fat stimuli with high attractiveness faces, $M = -0.55$, $SD = 0.75$, 95% CI [-0.93, -0.16], $t(16) = -3.01$, $p = .008$, $d = -0.73$. There was a non-significant ΔBISS after adaptation to high body fat adaptation stimuli with low attractiveness faces, $M = 0.26$, $SD = 0.86$, 95% CI [-0.24, 0.76], $t(13) = 1.14$, $p = .276$, $d = 0.30$.

Further analyses were conducted where direction of comparison was not assumed by adaptation condition but was instead based on the direction of comparison towards the overall attractiveness of the adaptation images, as reported by the participants. Participants who made neither upwards nor downwards comparisons were excluded from this analysis. The change in body dissatisfaction, for self-reported upwards or downwards comparison, is plotted in Figure 6.

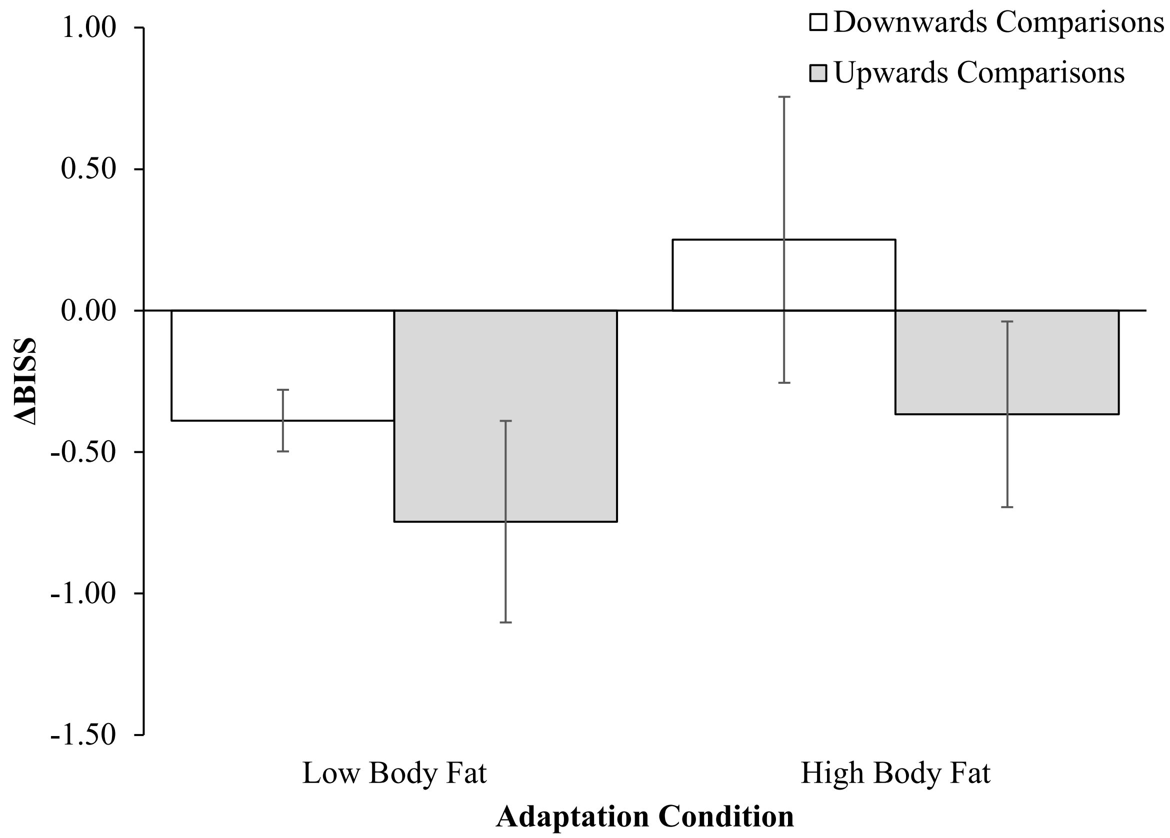

Figure 6. Mean change in body image states scale score (ΔBISS), split by body size and direction of comparison. Error bars represent 95% Confidence Intervals. A negative ΔBISS indicates participants became more dissatisfied with their body, and a positive ΔBISS indicates participants became more satisfied with their body

The outlier excluded in the previous analysis was included in this analysis, as it was not considered an outlier in this analysis. The low body fat downwards comparison group was not normally distributed due to its small sample size (n = 3), with a Shapiro-Wilk test, $p < .001$. As a sample size of 3 is not large enough to provide enough data to accurately determine normal distribution of data, as well as one-sample t-tests being robust to violations, with respect to type 1 error, the analysis continued (Rhiel & Wilkie, 2017).

The alpha level for this analysis was set at .025 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995). There was a statistically significant decrease in BISS after upwards comparisons to low body fat stimuli, $M = -0.75$, $SD = 0.83$, 95% CI [-1.13, -0.37], $t(20) = -4.11$, $p = .001$, $d = -0.53$, and downwards comparison to low body fat stimuli, $M = -0.39$, $SD = 0.10$, 95% CI [-0.63, -0.15], $t(2) = -7.00$, $p = .020$, $d = -4.04$, as this condition contained only 3 participants it should be interpreted with caution. There was a non-significant ΔBISS after upwards comparisons to high body fat adaptation stimuli, $M = -0.37$, $SD = 0.75$, 95% CI [-0.72, -0.02], $t(19) = -2.19$, $p = .041$, $d = -0.49$, and downwards comparisons to high body fat stimuli, $M = 0.25$, $SD = 0.73$, 95% CI [-0.36, -0.86], $t(7) = 0.97$, $p = .365$, $d = 0.34$.

Hypothesis 2: Effect of the amount of comparison on body satisfaction.

To test whether participants who made comparisons to a greater extent had a greater ΔBISS than participants who made comparisons to a lesser extent, an analysis of covariance (ANCOVA) was performed to determine whether the extent participants compared themselves, measured by state appearance, accounted for a significant amount of variance in ΔBISS. The independent variables were body size (high and low body fat) and facial attractiveness (high and low). The covariate was the state appearance comparison score.

There was one outlier in the low attractiveness low body fat adaptation group, as assessed with studentized residuals greater than ±3 standard deviations. The low attractiveness low body fat adaptation group's studentized residuals were not normally distributed, as assessed by Shapiro-Wilk's test, $p = .047$. All adaptation groups were normally distributed after the removal of the outlier. Contrary to our hypothesis, state appearance comparisons (SACS) did not significantly account for the variance in the change in body dissatisfaction, $F(1, 61) = 3.98$, $p = .051$, $\eta_p^2 = .061$.

To determine if state appearance comparisons affected the ΔBISS for each of the experimental conditions, we ran planned Pearson correlations. The alpha level for this analysis was set at .0125 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995). Contrary to our hypothesis, there were non-significant correlations between state appearance comparison and ΔBISS for those that saw low body fat and high attractiveness faces, , $r(15) = -.58$, $p = .014$, low body fat and low attractiveness faces, $r(12) = -.12$, $p = .683$, high body fat and high attractiveness faces, $r(19) = -.16$, $p = .477$, and high body fat and low attractiveness faces, $r(12) = .04$, $p = .900$. Therefore, our hypothesis was not supported.

We performed another ANCOVA and a correlational analysis using self-reported direction of comparison towards the stimulus overall, rather than facial attractiveness to determine direction of comparison. The outlier in the previous analysis was included in this analysis, as it was not considered an outlier in this analysis. When split by direction of comparison, state appearance comparisons did not significantly account for the variance in the change in body dissatisfaction, $F(1, 47) = 3.19$, $p = .080$, $\eta_p^2 = .064$.

To determine if state appearance comparisons affected the ΔBISS, we ran planned Spearman correlations, to account for the fact that data were not normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$), for each of the experimental conditions. The alpha level for this analysis was set at .0125 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995). In line with our hypothesis, participants who saw low body fat stimuli and made upwards comparisons had a significant moderate negative correlation between state appearance comparison and ΔBISS, $r_s(19) = -0.54$, $p = .012$. However, there were non-significant correlations between state appearance comparison and ΔBISS for those that saw low body fat stimuli and made downward comparisons, $r_s(1) = -0.87$, $p = .333$, high body fat and upward comparisons, $r_s(18) = -0.08$, $p = .752$, and high body fat and downward comparisons, $r_s(6) = 0.17$, $p = .693$. Therefore, our hypothesis was only partially supported.

Body Adaptation

Hypothesis 3: Effect of body size on change in PSN.

To test whether viewing low (high) body fat bodies during adaptation would result in participants selecting a smaller (larger) body as their perceived body size post-adaptation, than pre-adaptation, two one-sample t-tests were performed, split by body fat adaptation condition. Figure 7 shows the mean ΔPSN split by body fat adaptation condition and facial attractiveness.

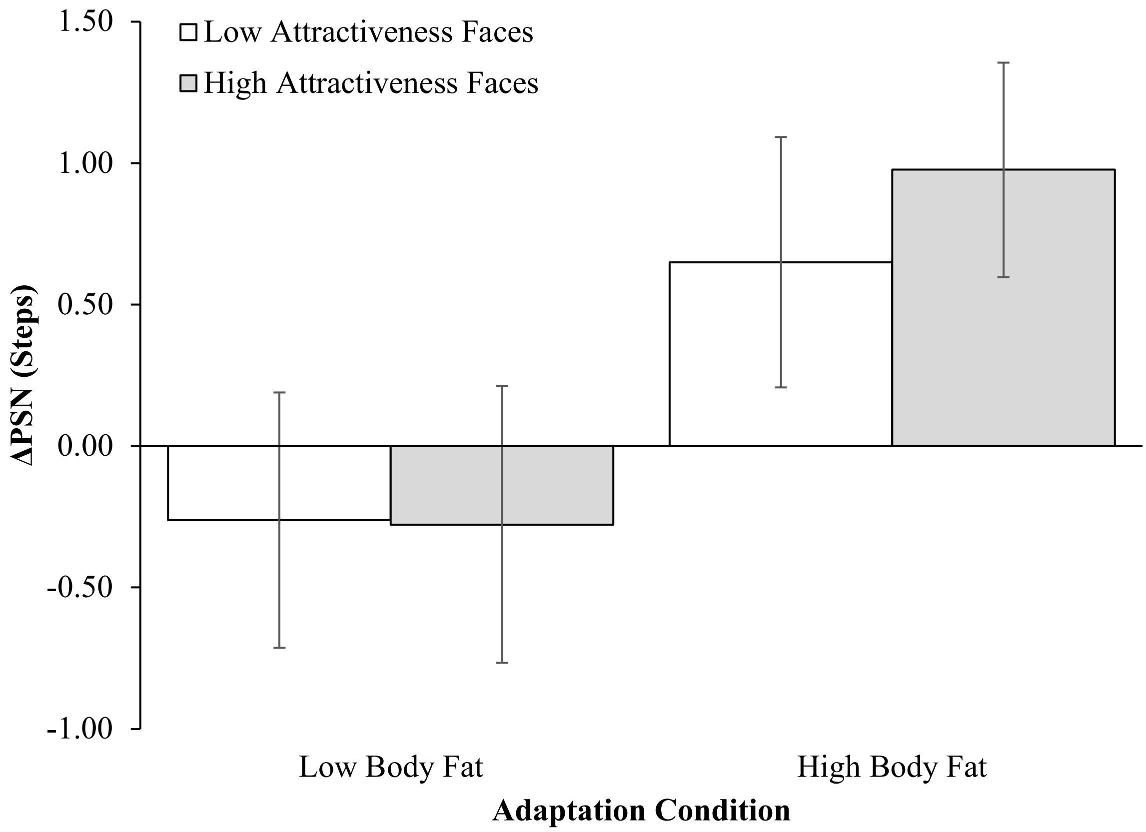

Figure 7. Mean change in the point of subjective normality (ΔPSN) for each condition. Error bars represent 95% Confidence Intervals.

Data for the low body fat condition was not normally distributed data as assessed by Shapiro-Wilk's test (p = .033), however, as one sample t-tests are robust to violations of normality with respect to type 1 error for a sample of this size, analysis proceeded (Rhiel & Wilkie, 2017). The alpha level was set at .025 using the Benjamini-Hochberg procedure

(Benjamini & Hochberg, 1995). Participants in the combined high body fat condition significantly increased their PSN after adaptation to high body fat images, 95% CI [0.55, 1.15], $t(34) = 5.74$, $p < .001$, $d = 0.97$. Participants' PSN did not change in the combined low body fat condition after adaptation to low body fat images, 95% CI [-0.58, 0.11], $t(31) = -1.41$, $p = .168$, $d = -0.25$.

Additional exploratory analyses were conducted. Results of a Spearman's correlation, to account for the fact that data were not normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$), found that there was a moderate significant negative association between ΔPSN and baseline BISS score in the combined low body fat adaptation condition, $r_s(30) = -.56$, $p = .001$. These findings indicate that as baseline BISS increased ΔPSN decreased. There was no significant correlation in the combined high body fat condition, $r_s(33) = -.27$, $p = .115$.

When split by the four adaptation conditions, the results did not differ from the previous results. The low attractiveness low body fat adaptation group was not normally distributed, as assessed by Shapiro-Wilk's test, $p = .007$, however, as one sample t-tests are robust to violations of normality with respect to type 1 error for a sample of this size, analysis proceeded (Rhiel & Wilkie, 2017). The alpha level was set at .025 using the Benjamini-Hochberg procedure (Benjamini & Hochberg, 1995). Change in PSN for high body fat adaptation was significant for low attractiveness faces, $t(13) = 2.88$, $p = .013$, and high attractiveness faces, $t(20) = 5.05$, $p < .000$. Change in PSN for low body fat adaptation was not significant for low attractiveness faces, $t(14) = -0.84$, $p = .415$, or high attractiveness faces, $t(16) = -1.11$, $p = .284$.

Hypothesis 4: Effect of direction of social comparison on change in PSN.

To test whether adapting to images with high attractiveness faces would result in participants selecting a larger body shape than participants adapting to low attractiveness faces a 2-way ANOVA was conducted, split by adaptation body size and facial attractiveness.

One of the groups was not normally distributed, with a Shapiro-Wilk test, $p = .007$, however, as ANOVA is robust to violations of normality analysis continued (Schmider, Ziegler, Danay, Beyer, & Bühner, 2010). Figure 7 shows the mean ΔPSN for each condition.

There was a significant main effect of the body size of the adaptation stimuli on the ΔPSN, $F(1, 63) = 21.33$, $p < .001$, $\eta_p^2 = .253$. Pairwise comparisons for simple main effects for low attractiveness face revealed a statistically significant mean difference of 0.84 between low body fat images and high body fat images, 95% CI [0.16, 1.53], $F(1,63) = 6.12$, $p = .016$, $\eta_p^2 = .088$. For high attractiveness faces, there was a statistically significant mean difference of 1.25 between low body fat and high body fat images, 95% CI [0.65, 1.85], $F(1,63) = 17.51$, $p < .001$, $\eta_p^2 = .217$. The alpha level for these analyses was set at .05 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995).

There was no significant main effect of facial attractiveness of the adaptation images on the ΔPSN, $F(1, 63) = 0.29$, $p = .594$, $\eta_p^2 = .005$. For high body fat images, there was non-significant mean difference in the ΔPSN between high and low attractiveness faces, of -0.33, 95% CI [-0.96, 0.31], $F(1,63) = 1.06$, $p = .307$, $\eta_p^2 = .017$. For low body fat images, the mean difference of 0.08 in the ΔPSN between high and low attractiveness faces was not significant, 95% CI [-0.57, 0.73], $F(1,63) = 0.065$, $p = .799$, $\eta_p^2 = .001$. The alpha level for these analyses was set at .025 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995).

There was a non-significant interaction effect between facial attractiveness and body size of the adaptation stimuli, $F\ (1, 63) = 0.81$, $p = .370$, $\eta_p^2 = .013$.

As the manipulation in this experiment failed for the low body fat conditions, we decided to rerun the previous analyses split by body size and self-reported direction of comparison towards the stimuli overall. Participants who made neither upwards nor downwards comparisons were excluded from this analysis. The low body fat downwards comparison group was not normally distributed due to its small sample size (n = 3), with a Shapiro-Wilk test, $p < .001$. As a sample size of 3 is not large enough to provide enough data to accurately determine normal distribution of data, as well as the robustness of ANOVA to violations of normality analysis continued (Schmider et al., 2010). Figure 8 shows the mean ΔPSN for each condition.

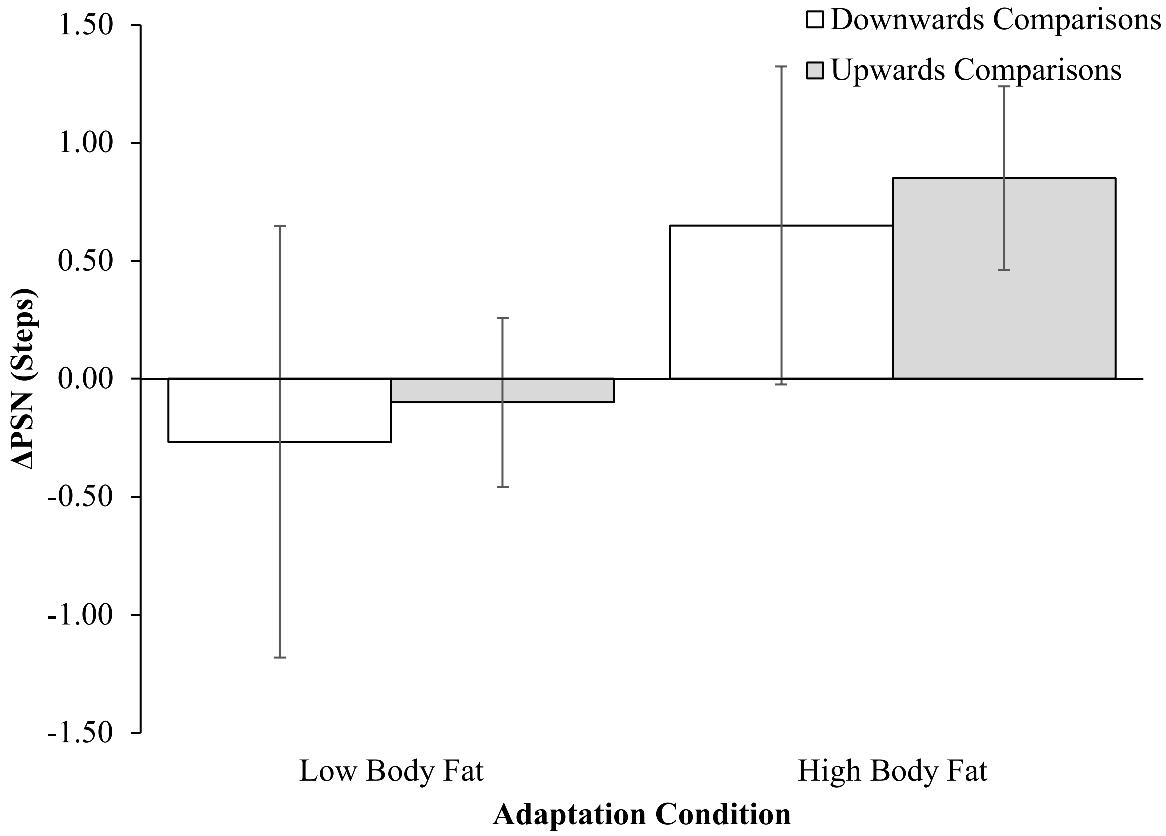

Figure 8. Mean change in the point of subjective normality (ΔPSN), split by body size and direction of comparison. Error bars represent 95% Confidence Intervals.

There was a significant main effect of the body size of the adaptation stimuli on the ΔPSN, $F(1, 48) = 8.15$, $p = .006$, $\eta_p^2 = .145$. For downward comparisons, the mean difference, of 0.92, in the ΔPSN between low body and high body fat images was not significant, 95% CI [-0.28, 2.11], $F(1,48) = 2.38$, $p = .129$, $\eta_p^2 = .047$. For upward comparisons, the mean difference, of 0.95, in the ΔPSN between low body and high body fat images was significant, 95% CI [0.40, 1.50], $F(1,48) = 12.02$, $p = .001$, $\eta_p^2 = .200$. The alpha level for these analyses was set at .025 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995).

There was no significant main effect of direction of comparison towards the adaptation images on the ΔPSN, F (1, 48) = 0.31, p = .578, η_p^2 = .007. For high body fat images, there was a non-significant mean difference in the ΔPSN between upwards and downwards comparisons, of -0.20, 95% CI [-0.94, 0.54] F(1,48) = 0.30, p = .588, η_p^2 = .006. For low body fat images, there was non-significant mean difference in the ΔPSN between upwards and downwards comparisons of -0.17, 95% CI [-1.26, 0.92] F(1,48) = 0.10, p = .759, η_p^2 = .002. The alpha level for these analyses was set at .025 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995).

There was a non-significant interaction effect between direction of comparison and body size of the adaptation stimuli, F (1, 48) = 0.00, p = .960, η_p^2 = .000.

Hypothesis 5: Effect of the extent of comparison on change in PSN.

To test whether the extent to which participants make appearance comparisons affected the ΔPSN, an analysis of covariance (ANCOVA) was performed to determine whether the extent participants compared themselves, measured by state appearance, accounted for a significant amount of variance in ΔPSN. The independent variables were body size (high and low body fat) and facial attractiveness (high and low). The covariate was the state appearance comparison score.

Studentized residuals were not normally distributed in one of the groups, as assessed by Shapiro-Wilk's test (p = .006). However, as ANCOVA is robust to violations of normality analysis continued (Levy, 1980).

Contrary to our hypothesis, state appearance comparisons did not significantly account for the variance in the change in the point of subjective normality, F(1, 62) = 0.08, p = .780, η_p^2 = .001.

To determine if state appearance comparisons affected the ΔPSN for each of the experimental conditions, we ran planned Spearman correlations, to account for the fact that data were not normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$), for each of the experimental conditions. The alpha level for this analysis was set at .0125 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995). There were non-significant correlations between state appearance comparison and ΔPSN for those that saw low body fat, high attractiveness faces, $r_s(15) = -.21$, $p = .413$, low body fat, low attractiveness faces, $r_s(13) = .21$, $p = .456$, high body fat, high attractiveness faces, $r_s(19) = -.01$ $p = .954$, and high body fat, low attractiveness faces, $r_s(12) = -.24$, $p = .401$. Therefore, our hypothesis was not supported.

We performed another ANCOVA and Spearman correlations, using self-reported direction of comparison rather than facial attractiveness to determine direction of comparison. The alpha level for this analysis was set at .0125 as determined by the Benjamini-Hochberg Procedure (Benjamini & Hochberg, 1995). When split by direction of comparison state appearance comparisons did not significantly account for the variance in the ΔPSN, $F(1, 47) = 0.28$, $p = .598$, $\eta_p^2 = .006$. There were non-significant correlations between state appearance comparison and ΔPSN for those adapted to low body fat stimuli and made upward comparisons, $r(19) = -0.06$, $p = .795$, low body fat and made downward comparisons, $r(1) = -0.57$, $p = .614$, high body fat and upward comparisons, $r(18) = -0.05$, $p = .826$, and high body fat and downward comparisons, $r(6) = -0.01$, $p = .977$. Therefore, our hypothesis was not supported.

Composites of Overall Attractiveness

A multiple regression was run to determine how much face and body attractiveness contributed to overall attractiveness. The multiple regression model significantly predicted overall attractiveness, $F(2,65) = 1415.65$, $p < .001$, $R^2_{Adjusted} = .98$. Attractiveness of the face contributed to more of the variance in the overall attractiveness, $R^2_{Adjusted} = .45$, than attractiveness of the body, $R^2_{Adjusted} = .30$. To determine if the facial attractiveness contributed to statistically more variance than body attractiveness, in other words the difference between facial and body attractiveness was statistically larger than equal contribution, the Mahalanobis distance was calculated, MD = 0.72, $p = 0.604$. Results indicated that the contribution of facial attractiveness compared to body attractiveness was not statistically different.

Discussion

Summary of Findings

This aim of this thesis is to determine whether social comparisons affect body adaptation effects and body satisfaction. The following hypotheses were proposed:

1. Viewing stimuli with high attractiveness faces will result in participants becoming more dissatisfied with their body, whilst viewing stimuli with low attractiveness faces is predicted to not significantly change body satisfaction.
2. Participants who made state appearance comparisons to a greater extent are predicted to have a larger change in body satisfaction than participants who made state appearance comparisons to a lesser extent.
3. Viewing thin (fat) bodies during adaptation will result in participants selecting a thinner (fatter) body as their perceived body size post-adaptation, than pre-adaptation.
4. Face attractiveness will affect the magnitude of participants' change in perception. Specifically, adaptation to images with high attractiveness faces will lead participants to select a larger body shape than participants adapting to stimuli with low attractiveness faces. See Figure 1 for a graphical representation of the predicted results.

5. Participants who made state appearance comparisons to a greater extent are predicted to have a larger adaptation effect than participants who made state appearance comparisons to a lesser extent.

The hypotheses were tested by manipulating the body size and the facial attractiveness of the stimuli. By manipulating body and face independently we hoped to encourage upwards (downwards) social comparison to images with high (low) attractiveness faces, and thus differentiate between the effects of body size adaptation and social comparison.

The first hypothesis was confirmed, as participants who made upwards comparisons (as determined by adaptation condition and self-report) towards the adaptation images became more dissatisfied with their body, while participants who made downwards comparisons did not experience a change of body satisfaction. The second hypothesis was partially confirmed. Participants that were exposed to low body fat images and made upwards comparisons became more dissatisfied with their body. However, this relationship was not found in any of the other adaptation conditions. The third hypothesis was also only partially supported. As predicted, adapting to high body fat stimuli resulted in participants selecting a larger body as their perceived body size post-adaptation than pre-adaptation. However, contrary to the predictions, we did not find a significant adaptation effect for low body fat adaptation stimuli. Testing our fourth hypothesis, we found that while participants in the high body fat condition who adapted to images with high attractive faces did select a larger body shape than participants adapting to low attractiveness faces, this difference was not significant. Similarly, there was no significant difference between facial attractiveness conditions for those that saw low body fat images. Finally, the fifth hypothesis was not supported with no relationship found between participants' state appearance comparisons and change in PSN.

Success of Manipulation

The present study examined the effect of social comparison direction on changing body satisfaction and changing body size perception in the context of prolonged exposure to bodies either with high or low levels of body fat. To investigate the effect of social comparisons we encouraged upwards and downwards comparisons towards the overall appearance of the adaptation stimuli, by manipulating facial attractiveness. Each participant was adapted to 5 different body stimuli with high or low attractiveness faces digitally imposed. Overall, manipulating the facial attractiveness of the stimuli was only partially successful in encouraging upwards and downwards comparisons towards the adaptation stimuli. We found that for the present stimuli we were successful in encouraging participants to perceive themselves as more or less attractive than the high body fat adaptation images by manipulating facial attractiveness. However, manipulation of facial attractiveness was not sufficient to encourage downward comparisons for low body fat adaptation images.

It is interesting that the facial attractiveness of high body fat adaptation stimuli was able to encourage upwards and downwards comparisons while the facial attractiveness of low body fat stimuli was not. This difference in comparison direction may be due to differences in participants, although demographic information from participants regarding baseline body satisfaction, baseline PSN, and BMI, suggest this is unlikely to be the case.

The present experiment used faces that have previously been rated on attractiveness. As the faces came from a small collection of approximately 100 faces, it is possible that the faces used for adaptation may not be extreme enough to elicit enough upwards and downwards comparison to counteract the influence of body size. Additionally, it is possible that the participants who had their face photographed are not representative of the general population, as people who perceive themselves to be of low facial attractiveness may be less likely to allow others to photograph their face. Future research may benefit from digitally altering pre-existing faces and validating these stimuli to ensure that the stimuli encourage the correct direction of comparison for a diverse group of women.

Alternatively, perhaps overall attractiveness is more complex than the sum of its parts (face and body). Previous research has found that when assessing attractiveness, the face is just as, if not more, important in determining overall attractiveness than the body (Brown et al., 1986; Peters et al., 2007; Riggio et al., 1991). Similarly, we found that direction of comparison towards the face was a better predictor of direction of comparison towards the overall stimuli than the direction of comparison towards the body shape of the stimuli, although this difference was not significant. However, it is also possible that direction of comparison towards the overall stimuli is not a simple sum of facial and body comparison. It is possible that the attractiveness of a feature rather than which feature it is, is more important in determining attractiveness. Alternatively, this could be explained by overall attractiveness being determined by the body parts participants spend the most time viewing, as research shows that dissatisfied participants spend more time attending to attractive aspects of an image of another person (Roefs et al., 2008). Such an effect would not be accounted for in the current analysis.

As the facial manipulation in the present study was only partially successful, the present research will discuss the findings analysed in terms of both direction of comparison implied by adaptation condition as well as self-reported direction of comparison.

Body Dissatisfaction Hypotheses

In this research we wanted to investigate the effect of body shape and facial attractiveness on body satisfaction.

Hypothesis 1: Effect of direction of comparison on body satisfaction.

It was hypothesised that viewing high attractiveness faces would result in participants becoming less satisfied with their body and low attractiveness faces were predicted to have little effect on body satisfaction. As predicted, participants who adapted to high attractiveness faces became more dissatisfied with their body, and participants in the high body fat condition who adapted to low attractiveness faces did not significantly change body satisfaction. However, as facial attractiveness was not able to encourage downwards comparisons for low facial attractiveness low body fat adaptation images, participants made upwards social comparisons. Consequently, only low attractiveness faces with high body fat bodies resulted in downward comparisons for most participants.

Investigating how different body shapes and levels of facial attractiveness affect body dissatisfaction is important for managing the effects of the media on people's body image. Previous literature has heavily emphasised how viewing idealised images of women can negatively affect body satisfaction, a finding we successfully replicated in this study (Groesz et al., 2002; Myers & Crowther, 2009).

Research has also investigated ways that we can minimise the effect that idealised images have on women's body satisfaction (Tiggemann & Anderberg, 2019; Tiggemann et al., 2019; Tiggemann & Velissaris, 2020). As the use of larger body shapes, to encourage downwards comparisons, has been found to maintain body satisfaction (Lin & Kulik, 2002) and sometimes increase satisfaction (Halliwell et al., 2005), the use of diverse body shapes is one strategy being promoted to reduce the negative effects of the media (Diedrichs & Lee, 2011; Lin & Kulik, 2002). However, the results of this study indicate that adjusting body size may not be an effective solution for minimising body dissatisfaction due to media consumption.

While the results did show that adaptation to high body fat images maintained current body satisfaction, this finding only occurred when low attractiveness faces were superimposed onto the low body fat images. Adaptation to high body fat women with high attractiveness faces resulted in participants becoming more dissatisfied with their body. This finding is problematic as it suggests that methods to improve body satisfaction by utilising models with more realistically shaped bodies, but with equally attractive faces, may not be adequate to prevent viewers from becoming dissatisfied.

Facial appearance has an important influence on a person's satisfaction with their body. Previous research by Warren (2012) found that people, on average, tended to be more dissatisfied with their lips, nose, and face, than their overall body. Results such as these highlight that body dissatisfaction is not exclusive to dissatisfaction with size but also encompasses dissatisfaction with other aspects of the body such as facial appearance.

Further, the more dissatisfied a person is the more likely they are to focus on the attractive aspects of an image of another person (Roefs et al., 2008). We predict that attention is likely being focused on whatever the viewer perceives to be the attractive aspects of the adaptation images (i.e. the face or the body), leading to more upwards comparisons and more body dissatisfaction. This would explain why participants who viewed low body fat or high attractiveness faces experienced body dissatisfaction.

Additionally, the present study found that performing downwards comparisons towards women in the adaptation images did not significantly increase body satisfaction. Although this finding was in line with our hypothesis it is worth noting that the adaptation condition that was successful in encouraging downwards comparisons did show a positive change in body satisfaction. As the condition only contained 14 participants and lacked adequate power, it is possible that future research may find evidence to support the suggestion that downwards comparisons may improve body satisfaction. This finding would be in line with studies that have found downward comparisons were able to improve body satisfaction (Slater et al., 2019; Tiggemann & Anderberg, 2019).

Ultimately, it is important that future research critically evaluates the effects of comparisons towards different aspects of an image (e.g. face, body, clothing) and how these comparisons interact to change body satisfaction. This research highlights how the focus of research and policy to the body size of models may be inadequate to successfully promote body satisfaction.

Hypothesis 2: Effect of the amount of comparison on body satisfaction.

It was hypothesised that participants' state appearance comparisons would affect their change in body satisfaction. Participants who made state appearance comparisons to a greater extent were predicted to have a larger change in body satisfaction than participants who made state appearance comparisons to a lesser extent. Contrary to our predictions, state appearance comparisons did not affect participants' change in body satisfaction. However, further analysis found that participants that viewed low body fat adaptation images and made upwards comparisons, determined by self-report, became more dissatisfied. However, no other relationships were found for any of the other adaptation conditions.

Previous studies have found that extent to which participants compared themselves was correlated with post exposure body dissatisfaction (Brown & Tiggemann, 2016, 2020; Tiggemann & Anderberg, 2019). These studies used images that promote upwards comparisons to investigate the effect of state appearance comparison and found that the greater the extent of their comparison the more dissatisfied a participant was likely to be. This relationship was found in the present study in the low body fat upwards comparison condition. However, all other conditions that produced upwards comparisons, as determined by either experimental condition or self-report, did not produce a significant relationship. All of these groups produced correlations in the correct direction, although none neared significance. We suspect that this lack of a significant effect is due to the lack of power in the current study as the relationship between state appearance comparisons and body dissatisfaction for upwards comparison images has been replicated numerous times (Brown & Tiggemann, 2016, 2020; Tiggemann & Anderberg, 2019).

Studies have found that for participants making upwards comparisons the greater the extent to which they compared themselves to the images, the more dissatisfied they became (Brown & Tiggemann, 2016, 2020). These studies have primarily focused on the effect of upwards comparisons, however, a study by Tiggemann and Anderberg (2019) did investigate downward comparisons in “Instagram vs reality” images. Participants were exposed to either ideal Instagram images, where pose, lighting, and digital enhancement had been used, real images, taken at the same time as the ideal images but from the perspective of an observer, and paired images, where ideal and real images were shown side by size. They found that the extent to which participants made comparison towards the experimental stimuli was correlated with the change in body dissatisfaction for participants who viewed ideal images. The extent to which participants made comparison towards the experimental stimuli was not correlated with body dissatisfaction for participants who viewed real images or paired image (real and ideal images). One limitation of the study was that direction of comparison was not measured but implied by the experimental images.

Although we predicted that participants who made state appearance comparisons to a greater extent would experience a greater change in body satisfaction for all experimental conditions, the present results seem to suggest that while the extent to which participants compare themselves impacts body satisfaction when making upwards comparisons, state appearance comparisons do not impact body satisfaction for participants who make downwards comparisons.

Body Adaptation Hypotheses

The main aim of this study was to investigate whether social comparisons affect the size of body adaptation effects. Before establishing this, we wanted to investigate whether our body adaptation conditions resulted in adaptation effects previously observed in the literature.

Hypothesis 3: Effect of body size on change in PSN.

It was hypothesised that viewing thin (fat) bodies during adaptation would result in participants selecting a thinner (fatter) body as their perceived body size post-adaptation, than pre-adaptation. As predicted, adapting to high body fat stimuli resulted in participants selecting a larger body as their perceived body size post-adaptation than pre-adaptation. However, contrary to our predictions and previous findings, we did not find a significant adaptation effect for low body fat adaptation stimuli, although results were in the correct direction.

Previous research has found that participants perceive a smaller body shape to be their accurate body shape after adaptation to low body fat images, and they perceive a larger body shape to be more accurate after adaptation to high body fat images (Brooks et al., 2016; Hummel, Grabhorn, et al., 2012; Hummel, Rudolf, et al., 2012; Mohr et al., 2016). These previous studies used similar sample sizes (between 16-35 participants per condition) and similar methods to this study, thus, ruling out the possibility of lack of power. However, our findings are similar to the eating disordered participants of Mohr et al. (2016).

Mohr et al. (2016) found that eating disordered participants did not experience an adaptation effect when viewing low body fat images, while healthy controls did experience an adaptation effect. They also found that eating disordered participants' change in PSN was negatively correlated with the severity of their eating pathology symptoms, with participants with greater eating disorder pathology less likely to experience an adaptation effect. Consequently, Mohr et al. (2016) predicted that a lack of an adaptation effect for eating disordered participants was the result of a pre-existing and long-lasting adaptation effect due to extensive viewing thin body shapes for inspiration. Although the present study was not conducted using eating disordered participants, and baseline body satisfaction scores were similar to other samples of female undergraduates (McFarlane, Urbszat, & Olmsted, 2011;

Santarossa & Woodruff, 2017), a similar pattern of results was observed. Not only was there a lack of a significant adaptation effect for low body fat adaptation stimuli, but there was also a negative correlation between change in PSN and body satisfaction indicating those that were more satisfied with their body experienced a larger adaptation effect.

In support of a pre-existing adaptation effect, participants with high body dissatisfaction are more likely to look at bodies with lower body fat more frequently and for longer periods of time (Blechert, Nickert, Caffier, & Tuschen-Caffier, 2009; Stephen, Sturman, et al., 2018). This would suggest that perhaps people with high body dissatisfaction are already experiencing an adaptation effect, where their perception has shifted. Consequently, the present adaptation stimuli are not causing a shift in perception but rather maintaining current perceptions of body size. This theory is supported by Glauert et al. (2009), who found that the more extreme the adaptation stimulus was in comparison to the participant's perception of normal the greater the body adaptation effect. While the extremity of the adaptation stimulus does play a role in the size of the adaptation effect it is unclear whether the extremity of the adaptation stimuli resulted in a lack of an adaptation effect in this study. Previous studies have been able to equate adaptation stimuli by making the adaptation stimuli a set number of steps larger than participants baseline PSN scores (Glauert et al., 2009; Mohr et al., 2016). Unfortunately, as the present study asked participants to report their own body size followed by adaptation images of other people, we are unable to determine if the extremity of the stimuli resulted in a lack of adaptation for low body fat images. However, the previously discussed study by Mohr et al. (2016) did equate adaptation stimuli, for each participant, and still reported similar results. The present study used some of the same body shapes as adaptation stimuli as previous studies that successfully changed participants PSN (Stephen, Bickersteth, Mond, Stevenson, & Brooks, 2016; Stephen, Sturman, et al., 2018). Consequently, we suggest that the lack of an adaptation effect for low body fat stimuli is unlikely to be the result of the extremity of the adaptation stimuli.

If dissatisfied participants had a pre-existing adaptation effect, we would expect to see dissatisfied participants select a thinner body size as most accurate at baseline, resembling a typical body size aftereffect. However, the present study found that dissatisfied participants tended to choose larger body sizes as their baseline PSN, a finding not reported by Mohr et al. (2016). These findings are in line with previous body estimation studies (Farrell et al., 2005; Gardner, 2011; Gardner & Brown, 2014; Tovee et al., 2000). Rather than dissatisfied participants being pre-adapted to low body fat images, the present findings suggest that a characteristic of body dissatisfied people is related to them not experiencing a typical body aftereffect.

We speculate that participants that are more dissatisfied at baseline are likely to make more upwards comparisons when viewing the adaptation images. Although we did not investigate if dissatisfied participants made more upwards comparisons, dissatisfied participants tend to focus more on the attractive aspects of an image of another person and focus on the unattractive body parts of images of themselves (Roefs et al., 2008). We predict that these social comparisons are affecting body size perception, resulting in a reduced adaptation effect when making upwards comparisons to low body fat stimuli. This relationship between social comparison and adaptation effects is the premise behind this research and is explored in more depth the next hypothesis.

Hypothesis 4: Effect of direction of social comparison on change in PSN.

The main purpose of this study was to investigate whether social comparisons affect the size of body adaptation effects. It was hypothesised that adapting to images with high attractiveness faces would result in participants selecting a larger body shape than participants adapting to low attractiveness faces.

Graphical representations of the results suggest that social comparisons may impact body size adaptation, although formal statistical analysis showed that social comparison direction, determined either by experimental condition or by self-reported direction of comparison, did not result in a significant difference in PSN. Consequently, our hypothesis was not supported. However, as only approximately one third of the originally intended number of participants were recruited, due to COVID-19, we believe these results are not conclusive enough to definitively suggest that social comparisons do not impact body adaptation effects.

Contrary to the direction predicted in the hypothesis, participants adapted to low body fat images selected a larger body shape when the adaptation stimuli had a low attractiveness face compared to a high attractiveness face, although this difference was not significant. It seems likely that the reason that adaptation to low attractiveness faces resulted in participants selecting a larger body shape than high attractiveness faces is due to participants making upwards comparisons in both experimental conditions. When additional analyses were performed using the self-reported direction of comparison as an independent variable, to account for the lack of downwards comparisons towards low attractiveness faces, participants who made upwards comparisons selected a larger body shape than participants who made downwards comparisons. Results from the second analysis were in line with the direction of our hypothesis, although the results were non-significant. Unfortunately, as only three participants made downward comparisons towards the low body fat stimuli, the present research did not have enough power to determine how direction of comparison affects low body fat stimuli.

The direction of comparison for high body fat stimuli was successfully manipulated by the facial attractiveness of the adaptation stimuli. Graphical representation of the results shows similar trends for direction of comparison split by facial attractiveness and self-reported direction of comparison. Although neither the analysis split by facial attractiveness or self-reported direction of comparison showed a significant difference between comparison direction, both analyses had on average a larger change in PSN for those that made more upwards comparisons. Although this finding does not provide evidence for social comparisons affecting change in PSN, it does provide reasonable justification for further research into social comparison and body adaptation.

It was predicted that participants who make upwards comparisons towards the overall attractiveness of the adaptation images would select a larger body shape as their PSN than participants who made downwards comparisons towards stimuli with the same body size. This prediction is made due to the suggestion that the change in PSN is a combination of the effects of adaptation and attitudes towards their body shape. This hypothesis was founded on previous studies that have shown that low body satisfaction was correlated with a higher perceived body size (Cornelissen et al., 2013). This finding, coupled with highly attractive media images making viewers more dissatisfied with their body, would suggest that viewing images that produce upwards comparisons may result in participants becoming more dissatisfied and selecting a larger body shape as their PSN (Groesz et al., 2002). We predict that this effect of body dissatisfaction on PSN is due to a shift in participant’s internal self-image rather than their perception, as participants with anorexia nervosa performed similarly to healthy controls in classifying other women’s body size, suggesting that anorexics do not experience an error in the way they perceive body shapes (Gledhill et al., 2019). This shift in a participant’s internal self-image may affect participants ability to accurately categorise body shapes as has been previously explored (Gledhill et al., 2017; Irvine et al., 2020). In these situations, participants may incorrectly classify thin body shapes as fat, thereby affecting body satisfaction. Consequently, the effect of upwards comparisons on PSN would add on to the change in PSN due to adaptation effects, resulting in a significant difference in the change in PSN between participants that made upwards and downwards comparisons for the same body shape.

Although the current results are inconclusive, it is possible that social comparison does not impact the change in PSN due to adaptation. A lack of a relationship between social comparison and body adaptation effects would require further research to determine why participants who are more dissatisfied with their body do not experience a typical adaptation effect to low body fat stimuli. One theory could be the influence of demand characteristics on responding, with dissatisfied participants more likely to select a larger PSN after adaptation to low body fat stimuli due to the belief that looking at these images should make them more dissatisfied with their body and see themselves as larger than they really are. Consequently, the effect of demand characteristics may be cancelling out the adaptation effect.

Overall, although no significant effect of social comparison on body size perception was found, we think that with further research and a larger sample size a significant effect remains a genuine possibility.

Hypothesis 5: Effect of the amount of comparison on change in PSN.

In addition to direction of comparison, we also investigated the effect of how much participants compared themselves to the adaptation stimuli and how this affected the change in PSN. It was hypothesised that participants' state appearance comparisons would affect the change in the point of subjective normality, with participants who make more state appearance comparisons predicted to have a larger adaptation effect than participants with lower state appearance comparisons. Contrary to our hypothesis, we found that participants' state appearance comparisons did not affect the change in PSN and there were no significant correlations between change in PSN and state appearance comparisons for any of the experimental conditions, even when direction of comparison was determined by self-report. Visual inspection of the results did not reveal any trends that would be likely to be significant if further research was conducted with enough power to detect a significant effect. Consequently, the present findings suggest that the extent of state appearance comparisons does not affect body size adaptation effects.

Although we did not find any trends to suggest a significant effect this may be due to the limitations of this experiment. In the current sample, participants tended to compare themselves to a great extent with the adaptation stimuli. Without participants who report a variety of different state appearance comparison scores, analysis cannot detect how the extent participants compare themselves affects body size adaptation effects. Further, self-report measures are prone to error particularly when the anchors of our Likert scales are not standardised across participants, as one participant may perceive themselves as making a lot of comparisons while another participant may perceive themselves to be making only a few, although both participants made the same number of comparisons. Quantitative measures of social comparison where participants count the number of comparisons and their direction, as they occur, or log the amount of time spent making upwards or downwards comparisons may be useful alternative methods to effectively compare between participants (Leahey, Crowther, & Ciesla, 2011). However, these types of quantitative measures of social comparison do rely on participants being aware of their social comparisons which may inadvertently affect participants' comparisons. Consequently, studies often use the state appearance comparison scale as this allows for a quantitative measure of social comparisons that can be completed after the experiment, thereby not inadvertently affecting participants' comparisons.

The current study suggests that state appearance comparisons do not affect body size adaptation effects. However, as the state appearance comparison scale cannot determine the proportion of upwards to downwards comparisons performed, future research should investigate if a relationship between state appearance comparisons and body size perception remains non-significant when the proportion of upwards and downwards comparisons are accounted for.

Strengths

A major strength of the current study was the fact that our methodology allowed us to analyse the difference in change in PSN using identical bodies whose faces had been replaced to produce more or less attractive individuals. Previous studies of social comparison have relied on manipulations of body size or have asked participants to make appearance and intelligence comparisons towards adaptation stimuli (Halliwell & Dittmar, 2005; Tiggemann & Polivy, 2010). However, in order to determine how direction of social comparisons affects change in PSN, body size must be controlled for across upwards and downwards social comparison conditions, as any adjustment to body size would affect the change in PSN.

As previously mentioned, the study not only had a manipulation to encourage direction of social comparison, but the experiment also measured the direction of social comparison to check the effectiveness of the manipulation. Previous social comparison studies have not always checked the effectiveness of the manipulation used to encourage upwards and downwards comparisons. By not assessing the manipulation, these studies cannot determine if a lack of an effect is a true lack of an effect or due to the manipulation not being effective. This problem is particularly evident in studies investigating the effects of downward comparisons on body satisfaction (Slater et al., 2019).

This study also measured change in body satisfaction using pre- and post-exposure measures rather than a separate control condition, where participants experience no adaptation or view neutral stimuli. Studies that use control conditions are heavily influenced by outliers whose baseline body satisfaction is outside norms, consequently larger samples are needed to make inferences about how images affect body dissatisfaction. This problem with only collecting post-exposure measures of body dissatisfaction is highlighted in studies that show control participants who did not see any images of models being more dissatisfied than participants who did see images (Halliwell et al., 2005).

Limitations and Future Directions

A major limitation of the current study was the lack of power to detect a significant effect. Although our power analysis required 200 participants, we were only able to test 67, due to restrictions as a consequence of COVID-19. A lack of statistical power has impacted many of the analyses and as a consequence these results cannot definitively determine whether social comparisons do affect body size adaptation effects.

Another limitation of the study was the realism of the adaptation stimuli. The faces used in the adaptation stimuli that have been validated and the bodies used as stimuli have also been shown to produce adaptation effects in previous studies (Stephen et al., 2016; Stephen, Sturman, et al., 2018). However, overlaying the faces on the bodies did prove to be a challenge. Factors such as skin tone, face to neck ratio, and head to body size ratio had to be considered to create a standardised image that appeared realistic. The need for standardisation meant that some of the images may have looked doctored, which may have influenced participants' thoughts about the images and consequently their comparisons. Future studies that use a similar method may benefit from collecting data about how realistic participants thought the images were.

This study is the first to investigate whether social comparisons affect body size aftereffects. Although the present study did not find a significant effect (most likely due to lack of power), future studies would benefit from replicating this study with a larger population. Additionally, future studies should also investigate how upward and downward comparisons affect body aftereffects when compared to adaptation without social comparison. As social comparisons are cognitively inefficient, having participants complete a complex task while undergoing adaptation, would allow for comparisons between the presence and lack of social comparison (Want & Saiphoo, 2017). This would allow researchers to determine if upwards and downwards comparisons affect body size aftereffects or if only upwards comparisons affect body size aftereffects. However, as previous face adaptation studies have found that active attention towards stimuli resulted in greater face adaptation effects than passively viewing face stimuli (Rhodes et al., 2011), the suggested methodology may inadvertently reduce adaptation effects.

Additionally, the present study used a convenience sample of young women, consequently these findings cannot be generalised to the broader population. Future studies should investigate whether social comparisons affect body size aftereffects in men and more diverse age groups.

Conclusion

In conclusion, this study is the first to investigate whether social comparisons affect body size aftereffects. While this research did not find any significant relationship between social comparison and body size aftereffects, we believe that there is sufficient evidence to warrant further study. The present research also explored how upwards and downwards comparisons to the face and body impact on body adaptation. These findings have important implications for the development of strategies to mitigate body dissatisfaction due to media consumption. This study also increases our understanding of how social comparison affects our body image.

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The Appendix of this thesis has been removed as it may contain sensitive/confidential content