

# Chapter 4

## Technology, Body Image, and Disordered Eating



### 4.1 Introduction

In general terms, *body image* refers to an individual's self-perception and cognitive appraisal of his or her own body. *Disordered eating* refers to a wide spectrum of eating patterns characterized as being detrimental to health, such as self-induced vomiting. Both body image and disordered eating have been linked to mass media exposure. Several studies have shown how mass media technologies such as television shape body image attitudes, which in turn can influence eating patterns (e.g., Levine & Harrison, 2009). However, human technology goes far beyond mass media technologies. The use of new media technologies, such as the Internet, provides new opportunities for creating and sharing digital content that may affect body image attitudes. Moreover, the rapid development of technologies is creating a disruptive transformation across a broad spectrum of human activities (United Nations, 2015). For instance, several decades ago it was not possible to use the human body to communicate with machines, and now that is feasible using brain-computer interfaces.

It is important to look beyond media influences on body image and to explore other ways in which technology can influence body image and disordered eating. With this idea in mind, the present chapter is split into two major sections. In the first section, our aim is to provide the reader with key concepts dealing with body image. We have therefore selected three major theoretical frameworks characterized by having a long tradition in exploring body image and disordered eating. These frameworks are cognitive-behavioral, sociocultural, and cognitive neuroscience. These three frameworks provide key concepts related to body image, necessary to better comprehend the link between technology, body image, and disordered eating. In the second section, our goal is to provide a brief overview of studies exploring the link between body image, disordered eating, and technology. In order to include diverse technologies in this discussion, we divide this second section into four subsections. The first two subsections are an overview of studies exploring the link

between body image, disordered eating, and traditional mass media technologies (such as television and magazines) along with the Internet and mobile technologies. The remaining two subsections explore how emerging and future technologies may be linked with body image and disordered eating.

## 4.2 Key Concepts Involved with Body Image

Body image is a complex phenomenon that has been studied by several disciplines, including behavioral science, cognitive science, philosophy, linguistics, and sociology, among others. Most of the knowledge and concepts regarding body image have been discussed and summarized in such substantial works such as Seymour Fisher's *Development and Structure of the Body Image (2 volumes)* (Fisher, 1986), the Aberdeen Body Group's compilation *The Body: Critical Concepts in Sociology (5 volumes)* (Blaikie et al., 2004), or more recently Thomas Cash's *Encyclopedia of Body Image and Human Appearance* (Cash, 2012b).

For this chapter we have identified three major frameworks that, taken together, can provide us a holistic perspective of body image. Thus, employing cognitive neuroscience, cognitive-behavioral, and sociocultural perspectives, we expect to provide the reader with key concepts used in the study of body image. These concepts will allow the reader to comprehend the relationship between technology, body image, and disordered eating, which is discussed in the second part of this chapter.

### 4.2.1 Cognitive-Behavioral Model

Within the cognitive-behavioral field, the work of Thomas Cash (2012a) on body image is renowned, because his theory integrates the most widely accepted components of behavioral sciences: perceptual, cognitive, and affective. According to Cash's theory, body image has two main dimensions: perceptual and attitudinal (Cash, 2012a). In this sense, body image can be defined as the self-perception and cognitive appraisal of the body (e.g., attitudes, thoughts) and affective responses to this appraisal (e.g., feelings). The perceptual dimension refers to the degree of accuracy we have in judging our body's physical dimensions. The attitudinal dimension, which is much more complex, implies body image attitudes which are "dispositional ways of thinking (cognitions), feeling (affect or emotions), and behaving" (Cash, 2012a, p. 334). Furthermore, in Cash's theory (2012a) body image attitudes are subdivided into two conceptually distinct components: body image *evaluation* (i.e., evaluative beliefs and extent of satisfaction or dissatisfaction/disparagement with the body or physical appearance) and body image *investment* (i.e., cognitive, behavioral, and emotional importance placed on the body or physical appearance).

Scholars have employed this distinction between body image *evaluation* and *importance* to study their association with disordered eating (e.g., Tiggemann, 2004).

Nevertheless, most of the attention has been focused on body image evaluation, under the general concept of body dissatisfaction (i.e., individuals' negative cognitive and affective appraisals of their own body including body features, shape, and weight). The interest in body dissatisfaction arises because there is evidence suggesting that body dissatisfaction is a powerful driver and predictor of disordered eating behaviors (Berge, Loth, Hanson, Croll-Lampert, & Neumark-Sztainer, 2012).

The other major component, body image investment, involves self-schemas about one's appearance, which are experience-based cognitive generalizations (e.g., assumptions, beliefs) serving to process appearance-relevant information (Cash, 2012a). Thus, appearance schematic persons would place more importance on appearance for judging self-worth (i.e., self-evaluative salience) and would consider having or maintaining an attractive appearance to be very important (i.e., motivational salience), being both the two main dimensions of body image investment (Cash, 2012a).

However, it is important to note that body image is not static but rather dynamic and diverse; this is due to several aspects, including individual differences and societal factors (Mills, Roosen, & Vella-Zarb, 2011). For instance, Cash (2005) suggests that when an individual encounters negative appearance evaluations (e.g., being teased), the individual uses coping strategies such as appearance fixing (i.e., correcting a perceived flaw in physical appearance), body avoidance (i.e., evading perceived threats to body image), and body acceptance (i.e., positive acceptance of body image experiences). Thus, the relationship between body image and disordered eating implies accounting for individual-level factors, such as self-regulating processes (Timko, Juarascio, Martin, Faherty, & Kalodner, 2014).

The cognitive-behavioral model of body image provides key concepts to explain the relationship between body image, disordered eating, and technology. Notably, most of the concepts from the cognitive-behavioral model have been integrated later by other empirically based models of body image, such as the sociocultural model (e.g., Cafri, Yamamiya, Brannick, & Thompson, 2005) and objectification theory (e.g., de Vries, Peter, Nikken, & de Graaf, 2014).

We will focus next on the sociocultural model, which is backed up by a large body of research explaining the link between technology (mostly media), body image, and disordered eating (see also Fig. 1.1 in Chap. 1 of this book). However, readers should be aware that objectification theory and identity-related theories, such as impression management theory, are also promising theoretical models to explain such a link (e.g., Melioli, Rodgers, Rodrigues, & Chabrol, 2015).

### **4.2.2 Sociocultural Model**

The sociocultural model integrates most of the concepts previously mentioned (see also Cash, 2005), but it places major emphasis on explaining how society and culture influence body image attitudes and disordered eating. Moreover, the sociocultural model is frequently used as a theoretical framework to explain the link between body image and eating disorders. The sociocultural model posits that the

key agents of socialization processes (i.e., parents, peers, and media) disseminate standards of beauty (e.g., an “ideal body”), to which people tend to compare themselves (a phenomenon called *social comparisons*), as well as cognitively to buy into these ideals or standards (a phenomenon called *internalization*) (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). The ideal body to which people tend to compare themselves, as well as internalize, is usually referred to as a thin but toned body for women (thin ideal) and a lean but toned body for men (muscular ideal) (Tylka, 2011).

Both the tendency to engage in social comparisons with the beauty ideal and the extent of internalization of such an ideal are both linked to our attitudes and perceptions in regard to our own body (Karazsia, van Dulmen, Wong, & Crowther, 2013; Myers & Crowther, 2009). As social individuals, we acquire information about ourselves by comparing with similar others or ideal others on relevant domains, such as physical appearance. This social comparison process is key to defining our self-concept, as well as modifying it through action. Moreover, social comparisons usually comprises the perception of *social norms* (i.e., what individuals think is done by others and what they believe must be done), which are linked to body image perceptions (e.g., Bair, Steele, & Mills, 2014). Similarly, social norms seem to be direct predictors of eating intentions and indirect predictors of eating behaviors (e.g., Hagger, Chan, Protogerou, & Chatzisarantis, 2016). Regarding internalization, several studies have shown that individuals not only internalize a beauty ideal but also internalize other appearance-related attitudes, such as weight bias (i.e., prejudicial and derogative views of overweight bodies) (Vartanian & Porter, 2016). Both kinds of internalization are strong predictors of body change behaviors including the development of eating disorders (e.g., Boswell & White, 2015; Homan, 2010; Schvey, Roberto, & White, 2013).

Nevertheless, it should be noted that some individuals are more prone to be influenced by sociocultural pressures than others. For instance, when an individual lacks a clearly defined sense of self, he or she may be more likely to seek out and adopt social norms of the beauty ideal as part of his/her own identity (Dittmar, 2009). Similarly, dispositional factors of the individual, from the most stable (e.g., personality traits) to the most transient (e.g., mood), as well as developmental factors (e.g., media preferences by age), and sociocultural factors (e.g., perceived group norms) together shape and are shaped by an individual’s selective media use (Valkenburg, Peter, & Walther, 2016). In other words, some individuals can be more susceptible to media effects, as well as more prone to engage with certain media content and interactions, such as appearance-focused media (Almenara, Machackova, & Smahel, 2016). Finally, our body image attitudes and perceptions are not static; rather, they interact with other cognitive processes to elicit action, such as the self-regulatory processes involved in body-related behaviors. For instance, some studies suggest that high levels of body dissatisfaction, coupled with high use of appearance fixing as a coping strategy, predict the consideration of cosmetic surgery (Callaghan, Lopez, Wong, Northcross, & Anderson, 2011).

In sum, taking together both the cognitive-behavioral and the sociocultural models, we can visualize body image as a dynamic spectrum of attitudes and perceptions (Mills et al., 2011), ranging from mindful body acceptance (Tylka & Wood-

Barcalow, 2015) to extreme body dissatisfaction (Davis & Scott-Robertson, 2000), embedded within a given sociocultural context.

### 4.2.3 *Cognitive Neuroscience*

Within cognitive neuroscience, there is no universally accepted taxonomy of brain-based or consciousness-based body representations, mostly due to the diversity of definitions (de Vignemont, 2016; Gaudio, Brooks, & Riva, 2014). Nevertheless, the most widely accepted types of body representations are *body schema* and *body image*, the former involving action and the latter linked to perception (Pitron & de Vignemont, 2017). *Body schema* refers to sensorimotor representations of the body based on a variety of sensory signals (e.g., proprioceptive, kinesthetic, tactile, etc.), which are collected from past bodily experiences and constantly updated to allow motor control and action without the necessity of conscious monitoring (Coslett, 2014; Di Vita, Boccia, Palermo, & Guariglia, 2016; Gallagher, 2005, 2017; Longo, 2016; Pitron & de Vignemont, 2017; Reed, 2002). *Body image* involves a more visual and semantic representation of the body, which includes perceptions, attitudes, beliefs, and emotions pertaining to one's own body and is thus more closely tied to an individual's conscious experience (Coslett, 2014; Di Vita et al., 2016; Gallagher, 2005). Although body schema and body image are usually treated as two distinct concepts, both systems interact with each other in forming intentional action (Gallagher, 2005). Thus, it is important to note that body schema and body image are intertwined (Pitron & de Vignemont, 2017).

Neuroscientific studies exploring the link between body image and eating pathologies have dealt with the perception of bodily processes (e.g., Ma-Kellams, 2014; Murphy, Brewer, Catmur, & Bird, 2017). These studies have focused on *interoception* (sensitivity to internal bodily signals such as hunger or satiety), *exteroception* (sensitivity to external body-related signals such as temperature), as well as the interaction between them (e.g., Zamariola, Cardini, Mian, Serino, & Tsakiris, 2017). The interest in perceived bodily processes arises because a "disturbance in the way in which one's body weight or shape is experienced" is a characteristic feature of anorexia nervosa (American Psychiatric Association, 2013, p. 338). The available evidence suggests that the integration of multiple sensory signals pertaining to the body (e.g., interoception) is impaired in individuals with anorexia nervosa (Gaudio et al., 2014). Similarly, obese individuals are believed to have a reduced interoceptive sensitivity, thus displaying difficulties in discriminating between internal signals of satiety and hunger (Herbert & Pollatos, 2014).

Experimental studies have shown that bodily processes are important for higher level cognitive functions, such as decision-making or memory (Herbert & Pollatos, 2012; Suitner, Koch, Bachmeier, & Maass, 2012). For instance, research has shown that body movement qualities (e.g., smooth rhythm) can influence what we recall and how we feel (Suitner et al., 2012). Thus, it is important to recognize the role of bodily processes in perception, cognition, and action. However, the study of bodily processes cannot occur in isolation but rather must be part of a dynamic systems

perspective (e.g., Koch, 2014), which includes the interaction of both interoceptive and exteroceptive perception or even more precisely an “extended proprioceptive experience” (e.g., Colpani, 2010). Adopting a complex dynamic systems perspective eschews the view of the body, mind, and environment as independent forms of actual existence and therefore breaks such classic dichotomies as body-mind or body-world (Choudhury & Slaby, 2012; Varela, Thompson, & Rosch, 2016). Following Slaby and Choudhury (2012), this adoption can be achieved by enriching our conceptual vocabularies and contributing to more complex and theory-rich explanations of behavior. In the case of studies on body image, it could imply adopting concepts such as embodiment, embodied cognition, embodied affectivity, enaction, and intersubjectivity, which are anchored within a general embodied framework (Fuchs, 2017; Gallagher, 2005; Varela et al., 2016; Winkielman, Niedenthal, Wielgosz, Eelen, & Kavanagh, 2015).

In fact, concepts such as embodiment or enaction form the basis of emerging paradigms in cognitive sciences, such as the 4EA approach (Choudhury & Slaby, 2012). 4EA conceptualizes the mind as *embodied*, *embedded*, *enacted*, *extended*, and *affective* (Choudhury & Slaby, 2012). Although there is no consensual definition of embodiment (Chrisley & Ziemke, 2003; Ziemke, 2003, for a review), it refers here to a view of cognition, not as individualized or independent, but rather tied to bodily processes and embedded within both the physical and the social environment (Choudhury & Slaby, 2012). Enaction, on the other hand, “refers to the dynamic integration of perception, cognition, and knowledge with action” (Choudhury & Slaby, 2012, p. 11), so that perception and action are intertwined, not differentiated.

To summarize, we have seen three major frameworks (cognitive-behavioral, sociocultural, and cognitive neuroscience perspectives) providing key concepts for discussing body image. Although these concepts come from diverse disciplines, they can be integrated into the general notion that body image is a dynamic phenomenon that comprises cognitive, affective, and social functions, as well as perception and sensitivity to internal/external bodily signals, which together provide the basis of a dynamic embodied experience, or enaction.

### 4.3 Traditional Media Technologies, Body Image, and Eating Behavior

Within the field of cognitive-behavioral psychology, and particularly in the study of eating disorders, sociocultural framework has been the mainstream model for explaining how traditional media technologies, such as television and magazines, promote body dissatisfaction (e.g., DeBraganza & Hausenblas, 2010). Although individuals’ body preferences are diverse across space and time (Karazsia, Murnen, & Tylka, 2017), sociocultural studies suggest that there are certain societal mechanisms able to modify body image attitudes, ideals, and preferences. One of these mechanisms is Westernization, which occurs due to globalization and the expansion of modernization (i.e., socioeconomic and cultural

transition of a society due to higher levels of industrialization and urbanization). In this regard, Westernization refers to the dissemination of Western values, such as the standards of beauty that interact with local beauty ideals (Anderson-Fye, 2018; Calogero, Boroughs, & Thompson, 2007; Levine & Smolak, 2010; Swami, 2015). For instance, studies have shown how Western standards of beauty, such as the thin ideal or the muscular ideal, are globally spread by traditional media through magazines (Yan & Bissell, 2014) and television (Becker, 2004; Becker, Burwell, Gilman, Herzog, & Hamburg, 2002; Boothroyd et al., 2016; Pritchard & Cramblitt, 2014). Furthermore, studies have shown that many individuals report their preference for these beauty ideals in Western and Westernized countries (e.g., Swami et al., 2010).

Studies exploring the content of popular magazines and television shows have found that such media display ways of behaving that can promote behaviors aimed at changing body image and eating patterns. Content analyses of popular women's and men's magazines have found that body shaping and weight management are major topics therein (Ethan, Basch, Hillyer, Berdnik, & Huynh, 2016; Ricciardelli, Clow, & White, 2010; Willis & Knobloch-Westerwick, 2014). Similarly, content analyses of popular television shows have found that weight-stigmatizing incidents are common, spreading obesity stigmatization (known colloquially as "fat shaming") and weight bias internalization (Eisenberg, Carlson-McGuire, Gollust, & Neumark-Sztainer, 2015; Fouts & Burggraf, 2000; Fouts & Vaughan, 2002).

In sum, there is considerable evidence suggesting that the exposure to traditional media influences body image attitudes, particularly by promoting body dissatisfaction.

However, susceptibility to media effects is highly mediated/moderated by individual differences (Valkenburg et al., 2016). Individual factors accounting for the diversity seen in media effects include, but are not limited to, self-esteem (e.g., Mischner, van Schie, & Engels, 2013), body image investment (Boersma & Jarry, 2013), personality traits (Roberts & Good, 2010), and cognitive schemas (López-Guimerà, Levine, Sánchez-Carracedo, & Fauquet, 2010).

#### **4.4 New Media Technologies, Body Image, and Eating Behavior**

Compared to traditional media, new media technologies (e.g., Internet-based digital platforms and applications such as Facebook) are ubiquitous. They also provide new opportunities for content creation, co-creation, and sharing. Many digital platforms and applications allow and encourage (or even focus on) posting and sharing photos and images by individual users. Similar to traditional media, this content can promote beauty standards, although now such content can be easily shared, endorsed, and commented on by users themselves (e.g., via social network sites, such as Instagram). Consequently, the use of these new media can have the same negative effects on body image as traditional media, such as promoting body dissatisfaction (Cohen & Blaszczynski, 2015). In this regard, most studies have focused

on examining how the exposure to content and interactions (engagement) on the Internet can influence body image and thus eating behavior. Therefore, we will focus next on studies exploring body-related content and interactions on the Internet, as well as individual-level factors accounting for the relationship between Internet use, body image, and disordered eating.

Several studies have shown how body ideals are portrayed and disseminated through the Internet (e.g., Slater, Tiggemann, Hawkins, & Werchon, 2012). For instance, a content analysis of popular street fashion blogs on the Internet found that most images of women (72%) portrayed a body weight below the average, reinforcing the thin ideal (Kraus & Martins, 2017). Nevertheless, it should be noted that, compared with consumers of traditional media, Internet users have the chance to create their own online content and spread it through the Internet, driving online audience and engagement around it (Almenara et al., 2016).

For instance, it is very common to see Internet users posting “thinspirational” content (e.g., images of emaciated young women with an eating disorder) or “fitspirational” content (e.g., an inspirational image of a fitness model lifting weights) on online social networks such as Instagram (e.g., Carrotte, Prichard, & Lim, 2017; Ghaznavi & Taylor, 2015; Santarossa, Coyne, Lisinski, & Woodruff, 2016). Since the Internet is so dynamic, this “inspirational content” can gain a substantial audience and engagement in a matter of minutes and potentially can go “viral” through diverse online threads in other social networks and platforms such as Reddit, Facebook, YouTube, WhatsApp, and even the news. This inspirational content includes a myriad of body shaping and weight management messages written by Internet users. For example, some Internet users encourage others to lose weight or increase muscularity by providing tips and tricks, as well as sharing their support (Murray et al., 2016; Santarossa et al., 2016).

Studies with young adults and adults have found that some Internet users tend to engage more than others in social and physical appearance comparisons on the Internet (Lewallen & Behm-Morawitz, 2016). For instance, individuals with a higher tendency for social comparisons are more likely to engage in “fat talk” (i.e., talking negatively about one’s body shape and size) and photo editing, as revealed by studies of online social network users (Arroyo & Brunner, 2016; Fox & Vendemia, 2016). This higher frequency of online social comparisons can be due to the fact that users can easily find online similar others including their peers, with whom they compare more often (Holland & Tiggemann, 2016). Previous studies have shown that social comparisons and “fat talk” are both linked with body dissatisfaction, particularly among women (Fardouly & Vartanian, 2016; Sharpe, Naumann, Treasure, & Schmidt, 2013). Similarly, body dissatisfaction and online appearance comparisons and online fat talk have all been linked with disordered eating in young women (Walker et al., 2015). Therefore, it is not uncommon to find individuals with eating disorders interacting with other users in online communities by sharing their experiences and support (e.g., Ransom, La Guardia, Woody, & Boyd, 2010)—for more details see also Chap. 7. In fact, some of these communities are called “pro-ana,” “pro-mia,” or “ana-mia” because they are seen as promoters of body dissatis-



faction and eating disorders (Rodgers, Lowy, Halperin, & Franko, 2016). However, online communities of marginalized individuals can also provide support through active community engagement and communication among members (Smith, Wickes, & Underwood, 2015). Similarly, online activism has been used as a resistant response of Internet users to the negative media portrayal of women's bodies (Lupton, 2017), as exemplified by the millions of Instagram posts with the hashtag "body positive" or "body positivity."<sup>1</sup> This form of activism and advocacy is seen as a powerful way to generate social change and social justice by disseminating the general idea of body diversity and thus helping to prevent body image and eating-related issues (Ferrari, 2012).

Women tend to experience stronger negative emotions than men when comparing their bodies with others perceived as higher status or desirable, in other words, when they engage in online upward body social comparisons (Fox & Vendemia, 2016). Moreover, women are also likely to engage in negative body talk and particularly "fat talk," to the extent that it seems to be the norm among young women, both online and offline (Barwick, Bazzini, Martz, Rocheleau, & Curtin, 2012; Walker et al., 2015). In contrast, males are more likely to be engaged with online content and interactions involving ways to increase weight and muscularity (Murray et al., 2016; Pila, Mond, Griffiths, Mitchison, & Murray, 2017). Finally, although the gender gap is not clear, some studies suggest that young and adult women are most likely to seek out weight-loss, nutrition, and fitness content and interactions on the Internet (Boepple & Thompson, 2016; Santarossa et al., 2016; Simpson & Mazzeo, 2017).

Some studies suggest that body image attitudes and perceptions can work as a mediator variable in the relationship between Internet use and body dissatisfaction or disordered eating. A mediator is a variable that transmits an effect in a causal sequence between an independent variable (e.g., Internet exposure) and an outcome (e.g., body dissatisfaction) (MacKinnon, Fairchild, & Fritz, 2007). For instance, it was recently found that individuals' own beliefs about their appearance (i.e., appearance self-schemas) and the extent of the discrepancy between their perceived physical appearance and the ideal were both mediators of the link between Instagram usage and body image satisfaction in young adults (Ahadzadeh, Pahlevan Sharif, & Ong, 2017). Similarly, a study with young women found that body shame (i.e., negative feelings after comparing with the ideal body) and body image avoidance both mediated the effect of Internet use on bulimic symptoms (Melioli et al., 2015).

In sum, the exposure to appearance-focused online content and interactions can promote body dissatisfaction and disordered eating, whereas individual-level factors such as gender can account as mediators/moderators of this effect (Holland & Tiggemann, 2016; Perloff, 2014; Prieler & Choi, 2014; Rodgers et al., 2016; see also Chap. 7 in this book).

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<sup>1</sup>As of the date of writing this chapter, there were over four million posts in Instagram with the hashtag #bodypositive. See: <https://www.instagram.com/explore/tags/bodypositive/>

## 4.5 Immersive Digital Technologies, Body Image, and Eating Behavior

Though most of the attention related to body image and eating disorders is focused on the negative effects of media exposure, we should not ignore the potential benefits provided by modern technologies. At present, there is some evidence suggesting that bodily processes and experiences can be positively modified through immersive digital technologies such as virtual reality (Riva, Baños, Botella, Mantovani, & Gaggioli, 2016). Virtual reality refers to interactive computer simulations and interactions through the senses (e.g., visual, auditory) that give participants the feeling of being immersed in the simulation (Rubio-Tamayo, Gertrudix Barrio, & García García, 2017). The earliest accounts of using virtual reality to positively modify body image were aimed at reducing body dissatisfaction by increasing bodily awareness (e.g., Riva, 1998). Most recent developments try to stimulate bodily processes in a more integrative way, with the aim of improve body experiences and thus to impact on overall health and well-being (e.g., Riva, Serino, Di Lernia, Pavone, & Dakanalis, 2017). For instance, a study using a virtual reality environment to reproduce a highly realistic skinny body belly found that young women participants exposed to it reported decreased discrepancy between estimated and actual size of most body parts assessed (Serino et al., 2015). Similarly, a recent experimental study used an immersive virtual reality environment to successfully reduce overestimation of body parts among patients with anorexia nervosa (Keizer, van Elburg, Helms, & Dijkerman, 2016). Although these results seem promising, there is still the challenge integrating theory, empirical evidence, and appropriate experimental procedures that take into account design factors and user experience for human-computer interaction (Isçen, Gromala, & Mobini, 2014; Rubio-Tamayo et al., 2017).

## 4.6 Future Technologies, Body Image, and Eating Behavior

In recent years, humankind has been going through a fourth industrial revolution (Schwab, 2016). Based on the work of the World Economic Forum and Forum's Global Agenda Councils, Schwab (2016) has organized the main technological drivers behind this revolution into three clusters: digital, physical, and biological. Among the major *digital drivers*, we have the Internet of Things (IoT), blockchain technologies, big data, cloud computing, artificial intelligence, machine learning, and on-demand technology. The major *physical drivers* include autonomous vehicles, 3D printing, advanced robotics, and new materials. Finally, among the major *biological drivers* can be found genetic engineering and neurotechnology (Li, Hou, & Wu, 2017; Schwab, 2016).

Some of these emerging technologies are likely to influence body image as well as the ways that body image is related to eating behavior and disordered eating. At present, thanks to technologies such as nanotechnology, it is possible to carry with us very small electronic devices connected to the Internet (i.e., smart devices

with software, sensors, etc.). In a similar fashion, future technologies will allow us to incorporate those devices into our bodies, carrying with us not only hardware and software but also a huge amount of data that will be integrated with our bodily functions as part of interconnected systems, such as distributed ledgers (e.g., a blockchain from the public health system). In turn, thanks to deep learning (a computational technique for modeling information automatically) and artificial intelligence (computational tasks that would require intelligence if done by humans), these interconnected systems will be constantly monitored, improved, and tweaked toward a constant perfection (i.e., updated). Moreover, genetic engineering and biohacking (e.g., tweaking your own DNA) could hypothetically allow humans in the future to override actual bodily limits, such as those regarding body schema and particularly multisensory integration, other than prolonging their lifespan and the visible consequences of aging in the body literally transforming a human body into a cyborg. Moreover, new technologies will allow us in the future to create a better and more realistic virtual version of ourselves (i.e., hyperrealistic avatar; Park, 2018), and this could have an important effect on the way we perceive our bodies. In sum, it could be hypothesized that emerging and future technologies will be disruptive in terms of body schema, body image, and embodiment (i.e., bodily processes as a precondition for cognition). In this sense, we agree with scholars in the field of human-computer interaction who have called to apply embodied cognition to the study of body image (Isken et al., 2014).

Regarding the link between body image and eating behavior, this hypothetical cognitive disruption on how we perceive and experience body image could bring new body ideals, as well as new eating patterns, and new eating disorders. Thus, we propose hypothetical future scenarios that could emerge regarding body perception, body parts, and bodily functions.

First, digital realities could hypothetically reduce the importance we place on the physical body, directing the attention toward our digital identities. As seen in the futuristic short film “Uncanned Valley” by Federico Heller,<sup>2</sup> some individuals could spend most of their time immersed in a virtual reality. Therefore, individuals with high levels of body image investment and high engagement with the digital world can direct their attention toward their digital body and appearance, rather than their physical body. Moreover, due to their isolation, these individuals could be less exposed to the social norms pertaining to physical appearance in the physical world, and thus less likely to adopt and internalize beauty ideals from the physical world. The immediate potential effect of this kind of isolation from the physical world could be related to difficulties in obtaining appropriate nutrition (i.e., malnutrition). However, future technologies may be able to automate nutrient delivery, optimizing the bioavailability of nutrients and making eating behavior merely accessory.

Second, the whole body, as well as body parts, will in the future have improved functionalities—due, for example, to nanotechnological engineering at neural levels (Dalton-Brown, 2015). As we said above, future technology could improve the delivery and bioavailability of nutrients (e.g., proteins). Thus, optimal nutrition

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<sup>2</sup><https://vimeo.com/147365861> Archived in: [http://web.archive.org/web/\\*/https://vimeo.com/147365861](http://web.archive.org/web/*/https://vimeo.com/147365861)

could be tied to bioengineering to help boost fitness capacity and making increased muscularity attainable to many more people than today. Moreover, other improvements in body functionalities related to the senses (e.g., improved vision, taste, hearing) could advance in the same way as muscularity, bringing the perception that a “superbody” is attainable. Therefore, it could be possible that in the future some individuals will engage in behaviors aimed to attain this superbody with improved functionalities and increased muscularity.

In sum, although mere fantasy for us today, these hypothetical scenarios could suggest how new technologies might someday change our body schema, body image, and embodiment.

## 4.7 Conclusions

Body image is a complex phenomenon that has captivated the attention of several disciplines. Studies presented in this review have shown how body image is linked to eating behavior, particularly disordered eating. Moreover, we have shown how traditional media, such as television and magazines, along with new media technologies such as the Internet, can promote body image dissatisfaction and disordered eating behaviors. However, it is important to remember that such effects do not impact everyone; rather, they are mediated and moderated by individual characteristics. Further, a positive effect of the technologies has also been documented. For instance, fully immersive digital technologies, such as virtual reality, can be used to positively modify bodily processes, such as interoceptive awareness. Moreover, future technologies can bring into scene disruptive changes in cognition and embodiment and thus alter contemporary ideas about body image and eating behaviors.

## References

- Ahadzadeh, A. S., Pahlevan Sharif, S., & Ong, F. S. (2017). Self-schema and self-discrepancy mediate the influence of Instagram usage on body image satisfaction among youth. *Computers in Human Behavior*, *68*, 8–16. <https://doi.org/10.1016/j.chb.2016.11.011>
- Almenara, C. A., Machackova, H., & Smahel, D. (2016). Individual differences associated with exposure to “ana-mia” websites: An examination of adolescents from 25 European countries. *Cyberpsychology, Behavior, and Social Networking*, *19*(8), 475–480. <https://doi.org/10.1089/cyber.2016.0098>
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed.). Arlington, VA: American Psychiatric Association.
- Anderson-Fye, E. P. (2018). Cultural influences on body image and eating disorders. In W. S. Agras & A. Robinson (Eds.), *The Oxford handbook of eating disorders* (Vol. 1, 2nd ed., pp. 187–208). New York, NY: Oxford University Press.
- Arroyo, A., & Brunner, S. R. (2016). Negative body talk as an outcome of friends’ fitness posts on social networking sites: Body surveillance and social comparison as potential moderators. *Journal of Applied Communication Research*, *44*(3), 216–235. <https://doi.org/10.1080/00909882.2016.1192293>

- Bair, A., Steele, J. R., & Mills, J. S. (2014). Do these norms make me look fat? The effect of exposure to others' body preferences on personal body ideals. *Body Image, 11*(3), 275–281. <https://doi.org/10.1016/j.bodyim.2014.04.004>
- Barwick, A., Bazzini, D., Martz, D., Rocheleau, C., & Curtin, L. (2012). Testing the norm to fat talk for women of varying size: What's weight got to do with it? *Body Image, 9*(1), 176–179. <https://doi.org/10.1016/j.bodyim.2011.08.003>
- Becker, A. E. (2004). Television, disordered eating, and young women in Fiji: Negotiating body image and identity during rapid social change. *Culture, Medicine and Psychiatry, 28*(4), 533–559. <https://doi.org/10.1007/s11013-004-1067-5>
- Becker, A. E., Burwell, R. A., Gilman, S. E., Herzog, D. B., & Hamburg, P. (2002). Eating behaviours and attitudes following prolonged exposure to television among ethnic Fijian adolescent girls. *The British Journal of Psychiatry, 180*, 509–514. <https://doi.org/10.1192/bjp.180.6.509>
- Berge, J. M., Loth, K. A., Hanson, C., Croll-Lampert, J., & Neumark-Sztainer, D. R. (2012). Family life cycle transitions and the onset of eating disorders: A retrospective grounded theory approach. *Journal of Clinical Nursing, 21*(9–10), 1355–1363. <https://doi.org/10.1111/j.1365-2702.2011.03762.x>
- Blaikie, A., Hepworth, M., Holmes, M., Howson, A., Inglis, D., & Sartain, S. (2004). *The body: Critical concepts in sociology* (5 volumes). New York, NY: Psychology Press.
- Boepple, L., & Thompson, J. K. (2016). A content analytic comparison of fitspiration and thin-spiration websites. *International Journal of Eating Disorders, 49*(1), 98–101. <https://doi.org/10.1002/eat.22403>
- Boersma, K. E., & Jarry, J. L. (2013). The paradoxical moderating effect of body image investment on the impact of weight-based derogatory media. *Body Image, 10*(2), 200–209. <https://doi.org/10.1016/j.bodyim.2012.11.002>
- Boothroyd, L. G., Jucker, J.-L., Thornborrow, T., Jamieson, M. A., Burt, D. M., Barton, R. A., ... Tovee, M. J. (2016). Television exposure predicts body size ideals in rural Nicaragua. *British Journal of Psychology, 107*(4), 752–767. <https://doi.org/10.1111/bjop.12184>
- Boswell, R. G., & White, M. A. (2015). Gender differences in weight bias internalisation and eating pathology in overweight individuals. *Advances in Eating Disorders, 3*(3), 259–268. <https://doi.org/10.1080/21662630.2015.1047881>
- Cafri, G., Yamamiya, Y., Brannick, M. T., & Thompson, J. K. (2005). The influence of socio-cultural factors on body image: A meta-analysis. *Clinical Psychology: Science and Practice, 12*(4), 421–433. <https://doi.org/10.1093/clipsy/bpi053>
- Callaghan, G. M., Lopez, A., Wong, L., Northcross, J., & Anderson, K. R. (2011). Predicting consideration of cosmetic surgery in a college population: A continuum of body image disturbance and the importance of coping strategies. *Body Image, 8*(3), 267–274. <https://doi.org/10.1016/j.bodyim.2011.04.002>
- Calogero, R. M., Boroughs, M., & Thompson, J. K. (2007). The impact of Western beauty ideals on the lives of women: A sociocultural perspective. In V. Swami & A. Furnham (Eds.), *Body beautiful: Evolutionary and sociocultural perspectives* (pp. 259–297). Basingstoke, UK: Palgrave Macmillan. [https://doi.org/10.1057/9780230596887\\_13](https://doi.org/10.1057/9780230596887_13).
- Carrotte, R. E., Prichard, I., & Lim, C. M. S. (2017). "Fitspiration" on social media: A content analysis of gendered images. *Journal of Medical Internet Research, 19*(3), e95. <https://doi.org/10.2196/jmir.6368>
- Cash, T. F. (2005). The influence of sociocultural factors on body image: Searching for constructs. *Clinical Psychology: Science and Practice, 12*(4), 438–442. <https://doi.org/10.1093/clipsy/bpi055>
- Cash, T. F. (2012a). Cognitive-behavioral perspectives on body image. In T. F. Cash (Ed.), *Encyclopedia of body image and human appearance* (pp. 334–342). San Diego, CA: Elsevier. <https://doi.org/10.1016/B978-0-12-384925-0.00054-7>
- Cash, T. F. (2012b). *Encyclopedia of body image and human appearance*. London, UK: Elsevier. <https://doi.org/10.1016/C2010-1-66177-9>
- Choudhury, S., & Slaby, J. (2012). Introduction: Critical neuroscience, between lifeworld and laboratory. In S. Choudhury & J. Slaby (Eds.), *Critical neuroscience: A handbook of the*

- social and cultural contexts of neuroscience* (pp. 1–26). Chichester, UK: Wiley. <https://doi.org/10.1002/9781444343359.ch>
- Chrisley, R., & Ziemke, T. (2003). Embodiment. In L. Nadel (Ed.), *Encyclopedia of cognitive science*. Hoboken, NJ: Wiley. <https://doi.org/10.1002/0470018860.s00172>
- Cohen, R., & Blaszczynski, A. (2015). Comparative effects of Facebook and conventional media on body image dissatisfaction. *Journal of Eating Disorders*, 3(1), 23. <https://doi.org/10.1186/s40337-015-0061-3>
- Colpani, M. (2010). *New media shaping of perception of space and perception of the body* (Master's Thesis). University of Amsterdam, Netherlands.
- Coslett, H. B. (2014). Body representations: Updating a classic concept. In A. Chatterjee & H. B. Coslett (Eds.), *The roots of cognitive neuroscience: Behavioral neurology and neuropsychology* (pp. 221–236). New York, NY: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780195395549.003.0010>
- Dalton-Brown, S. (2015). What is nanotechnology, and what should we be worried about? In S. Dalton-Brown (Ed.), *Nanotechnology and ethical governance in the European Union and China: Towards a global approach for science and technology* (pp. 11–41). Cham, Switzerland: Springer International Publishing. [https://doi.org/10.1007/978-3-319-18233-9\\_2](https://doi.org/10.1007/978-3-319-18233-9_2)
- Davis, C., & Scott-Robertson, L. (2000). A psychological comparison of females with anorexia nervosa and competitive male bodybuilders: Body shape ideals in the extreme. *Eating Behaviors*, 1(1), 33–46. [https://doi.org/10.1016/S1471-0153\(00\)00007-6](https://doi.org/10.1016/S1471-0153(00)00007-6)
- de Vignemont, F. (2016). Bodily awareness. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy*. Metaphysics Research Lab, Stanford University. Retrieved from <https://plato.stanford.edu/entries/bodily-awareness/> and Archived in: <http://www.webcitation.org/71LtvebGI>
- de Vries, D. A., Peter, J., Nikken, P., & de Graaf, H. (2014). The effect of social network site use on appearance investment and desire for cosmetic surgery among adolescent boys and girls. *Sex Roles*, 71(9–10), 283–295. <https://doi.org/10.1007/s11199-014-0412-6>
- DeBraganza, N., & Hausenblas, H. A. (2010). Media exposure of the ideal physique on women's body dissatisfaction and mood: The moderating effects of ethnicity. *Journal of Black Studies*, 40(4), 700–716. <https://doi.org/10.1177/0021934708317723>
- Di Vita, A., Boccia, M., Palermo, L., & Guariglia, C. (2016). To move or not to move, that is the question! Body schema and non-action oriented body representations: An fMRI meta-analytic study. *Neuroscience and Biobehavioral Reviews*, 68, 37–46. <https://doi.org/10.1016/j.neubiorev.2016.05.005>
- Dittmar, H. (2009). How do “body perfect” ideals in the media have a negative impact on body image and behaviors? Factors and processes related to self and identity. *Journal of Social and Clinical Psychology*, 28(1), 1–8. <https://doi.org/10.1521/jscp.2009.28.1.1>
- Eisenberg, M. E., Carlson-McGuire, A., Gollust, S. E., & Neumark-Sztainer, D. R. (2015). A content analysis of weight stigmatization in popular television programming for adolescents. *International Journal of Eating Disorders*, 48(6), 759–766. <https://doi.org/10.1002/eat.22348>
- Ethan, D., Basch, C. H., Hillyer, G. C., Berdnik, A., & Huynh, M. (2016). An analysis of weight loss articles and advertisements in mainstream women's health and fitness magazines. *Health Promotion Perspectives*, 6(2), 80–84. <https://doi.org/10.15171/hpp.2016.14>
- Fardouly, J., & Vartanian, L. R. (2016). Social media and body image concerns: Current research and future directions. *Current Opinion in Psychology*, 9, 1–5. <https://doi.org/10.1016/j.copsyc.2015.09.005>
- Ferrari, M. (2012). Mass media 2: Advocacy, activism, and social change in the digital era: The potential of cyber-action. In G. L. McVey, M. P. Levine, N. Piran, & H. B. Ferguson (Eds.), *Preventing eating-related and weight-related disorders: Collaborative research, advocacy, and policy change* (pp. 113–144). Waterloo, ON: Wilfrid Laurier University Press.
- Fisher, S. (1986). *Development and structure of the body image* (2 volumes). New York, NY: Psychology Press.
- Fouts, G., & Burggraf, K. (2000). Television situation comedies: Female weight, male negative comments and audience reactions. *Sex Roles*, 42(9–10), 925–932. <https://doi.org/10.1023/A:1007054618340>

- Fouts, G., & Vaughan, K. (2002). Television situation comedies: Male weight, negative references, and audience reactions. *Sex Roles, 46*(11–12), 439–442. <https://doi.org/10.1023/A:1020469715532>
- Fox, J., & Vendemia, M. A. (2016). Selective self-presentation and social comparison through photographs on social networking sites. *Cyberpsychology, Behavior, and Social Networking, 19*(10), 593–600. <https://doi.org/10.1089/cyber.2016.0248>
- Fuchs, T. (2017). Intercorporeality and interaffectivity. In C. Meyer, J. Streeck, & J. S. Jordan (Eds.), *Intercorporeality: Emerging socialities in interaction* (pp. 3–23). New York, NY: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780190210465.003.0001>
- Gallagher, S. (2005). *How the body shapes the mind*. New York, NY: Oxford University Press. <https://doi.org/10.1093/0199271941.001.0001>
- Gallagher, S. (2017). *Enactivist interventions: Rethinking the mind*. New York, NY: Oxford University Press. <https://doi.org/10.1093/oso/9780198794325.001.0001>
- Gaudio, S., Brooks, S. J., & Riva, G. (2014). Nonvisual multisensory impairment of body perception in anorexia nervosa: A systematic review of neuropsychological studies. *PLoS One, 9*(10), e110087. <https://doi.org/10.1371/journal.pone.0110087>
- Ghaznavi, J., & Taylor, L. D. (2015). Bones, body parts, and sex appeal: An analysis of #thinspiration images on popular social media. *Body Image, 14*, 54–61. <https://doi.org/10.1016/j.bodyim.2015.03.006>
- Hagger, M. S., Chan, D. K. C., Protogerou, C., & Chatzisarantis, N. L. D. (2016). Using meta-analytic path analysis to test theoretical predictions in health behavior: An illustration based on meta-analyses of the theory of planned behavior. *Preventive Medicine, 89*(Suppl. C), 154–161. <https://doi.org/10.1016/j.ypmed.2016.05.020>
- Herbert, B. M., & Pollatos, O. (2012). The body in the mind: On the relationship between interoception and embodiment. *Topics in Cognitive Science, 4*(4), 692–704. <https://doi.org/10.1111/j.1756-8765.2012.01189.x>
- Herbert, B. M., & Pollatos, O. (2014). Attenuated interoceptive sensitivity in overweight and obese individuals. *Eating Behaviors, 15*(3), 445–448. <https://doi.org/10.1016/j.eatbeh.2014.06.002>
- Holland, G., & Tiggemann, M. (2016). A systematic review of the impact of the use of social networking sites on body image and disordered eating outcomes. *Body Image, 17*, 100–110. <https://doi.org/10.1016/j.bodyim.2016.02.008>
- Homan, K. (2010). Athletic-ideal and thin-ideal internalization as prospective predictors of body dissatisfaction, dieting, and compulsive exercise. *Body Image, 7*(3), 240–245. <https://doi.org/10.1016/j.bodyim.2010.02.004>
- Iscen, O. E., Gromala, D., & Mobini, M. (2014). Body image and body schema: Interaction design for and through embodied cognition. In M. Kurosu (Ed.), *Human-computer interaction. Advanced interaction modalities and techniques: 16th International Conference, HCI International 2014, Heraklion, Crete, Greece, June 22–27, 2014, Proceedings, Part II* (pp. 556–566). Cham, Switzerland: Springer International Publishing. [https://doi.org/10.1007/978-3-319-07230-2\\_53](https://doi.org/10.1007/978-3-319-07230-2_53)
- Karazsia, B. T., Murnen, S. K., & Tylka, T. L. (2017). Is body dissatisfaction changing across time? A cross-temporal meta-analysis. *Psychological Bulletin, 143*(3), 293–320. <https://doi.org/10.1037/bul0000081>
- Karazsia, B. T., van Dulmen, M. H. M., Wong, K., & Crowther, J. H. (2013). Thinking meta-theoretically about the role of internalization in the development of body dissatisfaction and body change behaviors. *Body Image, 10*(4), 433–441. <https://doi.org/10.1016/j.bodyim.2013.06.005>
- Keizer, A., van Elburg, A., Helms, R., & Dijkerman, H. C. (2016). A virtual reality full body illusion improves body image disturbance in anorexia nervosa. *PLoS One, 11*(10), 1–21. <https://doi.org/10.1371/journal.pone.0163921>
- Koch, S. C. (2014). Rhythm is it: Effects of dynamic body feedback on affect and attitudes. *Frontiers in Psychology, 5*, 537. <https://doi.org/10.3389/fpsyg.2014.00537>
- Kraus, A., & Martins, N. (2017). On the street: A content analysis of body imagery in street style fashion blogs. *Journal of Broadcasting & Electronic Media, 61*(2), 351–367. <https://doi.org/10.1080/08838151.2017.1309410>
- Levine, M. P., & Harrison, K. (2009). Effects of media on eating disorders and body image. In J. Bryant & M. B. Oliver (Eds.), *Media effects: Advances in theory and research* (3rd ed., pp. 490–516). New York, NY: Routledge.

- Levine, M. P., & Smolak, L. (2010). Cultural influences on body image and eating disorders. In W. S. Agras (Ed.), *The Oxford handbook of eating disorders* (pp. 223–246). New York, NY: Oxford University Press.
- Lewallen, J., & Behm-Morawitz, E. (2016). Pinterest or Thinterest?: Social comparison and body image on social media. *Social Media + Society*, 2(1), 1–9. <https://doi.org/10.1177/2056305116640559>
- Li, G., Hou, Y., & Wu, A. (2017). Fourth industrial revolution: Technological drivers, impacts and coping methods. *Chinese Geographical Science*, 27(4), 626–637. <https://doi.org/10.1007/s11769-017-0890-x>
- Longo, M. R. (2016). Types of body representation. In Y. Coello & M. H. Fischer (Eds.), *Perceptual and emotional embodiment: Foundations of embodied cognition* (Vol. 1, pp. 117–134). New York, NY: Routledge.
- López-Guimerà, G., Levine, M. P., Sánchez-Carracedo, D., & Fauquet, J. (2010). Influence of mass media on body image and eating disordered attitudes and behaviors in females: A review of effects and processes. *Media Psychology*, 13(4), 387–416. <https://doi.org/10.1080/15213269.2010.525737>
- Lupton, D. (2017). Digital media and body weight, shape, and size: An introduction and review. *Fat Studies*, 6(2), 119–134. <https://doi.org/10.1080/21604851.2017.1243392>
- Ma-Kellams, C. (2014). Cross-cultural differences in somatic awareness and interoceptive accuracy: A review of the literature and directions for future research. *Frontiers in Psychology*, 5, 1379. <https://doi.org/10.3389/fpsyg.2014.01379>
- MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation analysis. *Annual Review of Psychology*, 58(1), 593–614. <https://doi.org/10.1146/annurev.psych.58.110405.085542>
- Melioli, T., Rodgers, R. F., Rodrigues, M., & Chabrol, H. (2015). The role of body image in the relationship between internet use and bulimic symptoms: Three theoretical frameworks. *Cyberpsychology, Behavior, and Social Networking*, 18(11), 682–686. <https://doi.org/10.1089/cyber.2015.0154>
- Mills, J. S., Roosen, K., & Vella-Zarb, R. A. (2011). The psychology of body image: Understanding body image instability and distortion. In S. B. Greene (Ed.), *Body image: Perceptions, interpretations and attitudes* (pp. 59–80). New York, NY: Nova Science Publishers, Inc.
- Mischner, I. H. S., van Schie, H. T., & Engels, R. C. M. E. (2013). Breaking the circle: Challenging Western sociocultural norms for appearance influences young women's attention to appearance-related media. *Body Image*, 10(3), 316–325. <https://doi.org/10.1016/j.bodyim.2013.02.005>
- Murphy, J., Brewer, R., Catmur, C., & Bird, G. (2017). Interoception and psychopathology: A developmental neuroscience perspective. *Developmental Cognitive Neuroscience*, 23(Suppl. C), 45–56. <https://doi.org/10.1016/j.dcn.2016.12.006>
- Murray, S. B., Griffiths, S., Hazery, L., Shen, T., Wooldridge, T., & Mond, J. M. (2016). Go big or go home: A thematic content analysis of pro-muscularity websites. *Body Image*, 16, 17–20. <https://doi.org/10.1016/j.bodyim.2015.10.002>
- Myers, T. A., & Crowther, J. H. (2009). Social comparison as a predictor of body dissatisfaction: A meta-analytic review. *Journal of Abnormal Psychology*, 118(4), 683–698. <https://doi.org/10.1037/a0016763>
- Park, J. (2018). The effect of virtual avatar experience on body image discrepancy, body satisfaction and weight regulation intention. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, 12(1), article 3. <https://doi.org/10.5817/CP2018-1-3>
- Perloff, R. M. (2014). Social media effects on young women's body image concerns: Theoretical perspectives and an agenda for research. *Sex Roles*, 71(11–12), 363–377. <https://doi.org/10.1007/s11199-014-0384-6>
- Pila, E., Mond, J. M., Griffiths, S., Mitchison, D., & Murray, S. B. (2017). A thematic content analysis of #cheatmeal images on social media: Characterizing an emerging dietary trend. *International Journal of Eating Disorders*, 50, 698. <https://doi.org/10.1002/eat.22671>
- Pitron, V., & de Vignemont, F. (2017). Beyond differences between the body schema and the body image: Insights from body hallucinations. *Consciousness and Cognition*, 53, 115–121. <https://doi.org/10.1016/j.concog.2017.06.006>



- Prieler, M., & Choi, J. (2014). Broadening the scope of social media effect research on body image concerns. *Sex Roles, 71*(11–12), 378–388. <https://doi.org/10.1007/s11199-014-0406-4>
- Pritchard, M. E., & Cramblitt, B. (2014). Media influence on drive for thinness and drive for muscularity. *Sex Roles, 71*(5–8), 208–218. <https://doi.org/10.1007/s11199-014-0397-1>
- Ransom, D. C., La Guardia, J. G., Woody, E. Z., & Boyd, J. L. (2010). Interpersonal interactions on online forums addressing eating concerns. *The International Journal of Eating Disorders, 43*(2), 161–170. <https://doi.org/10.1002/eat.20629>
- Reed, C. L. (2002). What is the body schema? In A. N. Meltzoff & W. Prinz (Eds.), *The imitative mind: Development, evolution, and brain bases* (pp. 233–243). New York, NY: Cambridge University Press. <https://doi.org/10.1017/CBO9780511489969.014>
- Ricciardelli, R., Clow, K. A., & White, P. (2010). Investigating hegemonic masculinity: Portrayals of masculinity in men's lifestyle magazines. *Sex Roles, 63*(1–2), 64–78. <https://doi.org/10.1007/s11199-010-9764-8>
- Riva, G. (1998). Modifications of body-image induced by virtual reality. *Perceptual and Motor Skills, 86*(1), 163–170. <https://doi.org/10.2466/pms.1998.86.1.163>
- Riva, G., Baños, R. M., Botella, C., Mantovani, F., & Gaggioli, A. (2016). Transforming experience: The potential of augmented reality and virtual reality for enhancing personal and clinical change. *Frontiers in Psychiatry, 7*, 164. <https://doi.org/10.3389/fpsy.2016.00164>
- Riva, G., Serino, S., Di Lernia, D., Pavone, E. F., & Dakanalis, A. (2017). Embodied medicine: Mens sana in corpore virtuale sano. *Frontiers in Human Neuroscience, 11*, 120. <https://doi.org/10.3389/fnhum.2017.00120>
- Roberts, A., & Good, E. (2010). Media images and female body dissatisfaction: The moderating effects of the five-factor traits. *Eating Behaviors, 11*(4), 211–216. <https://doi.org/10.1016/j.eatbeh.2010.04.002>
- Rodgers, R. F., Lowy, A. S., Halperin, D. M., & Franko, D. L. (2016). A meta-analysis examining the influence of pro-eating disorder websites on body image and eating pathology. *European Eating Disorders Review, 24*(1), 3–8. <https://doi.org/10.1002/erv.2390>
- Rubio-Tamayo, J. L., Gertrudix Barrio, M., & García García, F. (2017). Immersive environments and virtual reality: Systematic review and advances in communication, interaction and simulation. *Multimodal Technologies and Interaction, 1*(4), 21. <https://doi.org/10.3390/mti1040021>
- Santarossa, S., Coyne, P., Lisinski, C., & Woodruff, S. J. (2016). #fitspo on Instagram: A mixed-methods approach using Netlytic and photo analysis, uncovering the online discussion and author/image characteristics. *Journal of Health Psychology, 65*. <https://doi.org/10.1177/1359105316676334>
- Schvey, N. A., Roberto, C. A., & White, M. A. (2013). Clinical correlates of the Weight Bias Internalization Scale in overweight adults with binge and purge behaviours. *Advances in Eating Disorders, 1*(3), 213–223. <https://doi.org/10.1080/21662630.2013.794523>
- Schwab, K. (2016). *The fourth industrial revolution*. Geneva, Switzerland: World Economic Forum.
- Serino, S., Pedroli, E., Keizer, A., Triberti, S., Dakanalis, A., Pallavicini, F., ... Riva, G. (2015). Virtual reality body swapping: A tool for modifying the allocentric memory of the body. *Cyberpsychology, Behavior, and Social Networking, 19*(2), 127–133. <https://doi.org/10.1089/cyber.2015.0229>
- Sharpe, H., Naumann, U., Treasure, J., & Schmidt, U. (2013). Is fat talking a causal risk factor for body dissatisfaction? A systematic review and meta-analysis. *International Journal of Eating Disorders, 46*(7), 643–652. <https://doi.org/10.1002/eat.22151>
- Simpson, C. C., & Mazzeo, S. E. (2017). Skinny is not enough: A content analysis of fitspiration on Pinterest. *Health Communication, 32*(5), 560–567. <https://doi.org/10.1080/10410236.2016.1140273>
- Slaby, J., & Choudhury, S. (2012). Proposal for a critical neuroscience. In S. Choudhury & J. Slaby (Eds.), *Critical neuroscience: A handbook of the social and cultural contexts of neuroscience* (pp. 29–51). Chichester, UK: Wiley. <https://doi.org/10.1002/9781444343359.ch1>
- Slater, A., Tiggemann, M., Hawkins, K., & Werchon, D. (2012). Just one click: A content analysis of advertisements on teen Web sites. *Journal of Adolescent Health, 50*(4), 339–345. <https://doi.org/10.1016/j.jadohealth.2011.08.003>

- Smith, N., Wickes, R., & Underwood, M. (2015). Managing a marginalised identity in pro-anorexia and fat acceptance cybercommunities. *Journal of Sociology*, *51*(4), 950–967. <https://doi.org/10.1177/1440783313486220>
- Suïtner, C., Koch, S. C., Bachmeier, K., & Maass, A. (2012). Dynamic embodiment and its functional role: A body feedback perspective. In S. C. Koch, T. Fuchs, M. Summa, & C. Müller (Eds.), *Body memory, metaphor and movement* (pp. 155–170). Philadelphia, PA: John Benjamins Publishing Company. <https://doi.org/10.1075/aicr.84.13sui>
- Swami, V. (2015). Cultural influences on body size ideals: Unpacking the impact of Westernization and modernization. *European Psychologist*, *20*(1), 44–51. <https://doi.org/10.1027/1016-9040/a000150>
- Swami, V., Frederick, D. A., Aavik, T., Alcalay, L., Allik, J., Anderson, D., ... Zivcic-Becirevic, I. (2010). The attractive female body weight and female body dissatisfaction in 26 countries across 10 world regions: Results of the International Body Project I. *Personality & Social Psychology Bulletin*, *36*(3), 309–325. <https://doi.org/10.1177/0146167209359702>
- Thompson, J. K., Heinberg, L. J., Altabe, M., & Tantleff-Dunn, S. (Eds.). (1999). *Exacting beauty: Theory, assessment, and treatment of body image disturbance*. Washington DC: American Psychological Association. <https://psycnet.apa.org/doi/10.1037/10312-000>
- Tiggemann, M. (2004). Body image across the adult life span: Stability and change. *Body Image*, *1*(1), 29–41. [https://doi.org/10.1016/S1740-1445\(03\)00002-0](https://doi.org/10.1016/S1740-1445(03)00002-0)
- Timko, C. A., Juarascio, A. S., Martin, L. M., Faherty, A., & Kalodner, C. (2014). Body image avoidance: An under-explored yet important factor in the relationship between body image dissatisfaction and disordered eating. *Journal of Contextual Behavioral Science*, *3*(3), 203–211. <https://doi.org/10.1016/j.jcbs.2014.01.002>
- Tylka, T. L. (2011). Refinement of the tripartite influence model for men: Dual body image pathways to body change behaviors. *Body Image*, *8*(3), 199–207. <https://doi.org/10.1016/j.bodyim.2011.04.008>
- Tylka, T. L., & Wood-Barcalow, N. L. (2015). What is and what is not positive body image? Conceptual foundations and construct definition. *Body Image*, *14*, 118–129. <https://doi.org/10.1016/j.bodyim.2015.04.001>
- United Nations. (2015). *Digital development: Report of the secretary-general (E/CN.16/2015/2)*. Geneva. Retrieved from [http://unctad.org/meetings/en/SessionalDocuments/ecn162015d2\\_en.pdf](http://unctad.org/meetings/en/SessionalDocuments/ecn162015d2_en.pdf) and Archived in: <http://www.webcitation.org/71LjUib71>
- Valkenburg, P. M., Peter, J., & Walther, J. B. (2016). Media effects: Theory and research. *Annual Review of Psychology*, *67*(1), 315–338. <https://doi.org/10.1146/annurev-psych-122414-033608>
- Varela, F. J., Thompson, E., & Rosch, E. (2016). *The embodied mind: Cognitive science and human experience* (2nd ed.). Cambridge, MA: The MIT Press.
- Vartanian, L. R., & Porter, A. M. (2016). Weight stigma and eating behavior: A review of the literature. *Appetite*, *102*, 3–14. <https://doi.org/10.1016/j.appet.2016.01.034>
- Walker, M., Thornton, L., De Choudhury, M., Teevan, J., Bulik, C. M., Levinson, C. A., & Zerwas, S. (2015). Facebook use and disordered eating in college-aged women. *Journal of Adolescent Health*, *57*(2), 157–163. <https://doi.org/10.1016/j.jadohealth.2015.04.026>
- Willis, L. E., & Knobloch-Westerwick, S. (2014). Weighing women down: Messages on weight loss and body shaping in editorial content in popular women's health and fitness magazines. *Health Communication*, *29*(4), 323–331. <https://doi.org/10.1080/10410236.2012.755602>
- Winkielman, P., Niedenthal, P. M., Wielgosz, J., Eelen, J., & Kavanagh, L. C. (2015). Embodiment of cognition and emotion. In M. Mikulincer & P. R. Shaver (Eds.), *APA handbook of personality and social psychology: Attitudes and social cognition* (Vol. 1, pp. 151–175). Washington, DC: American Psychological Association. <https://psycnet.apa.org/doi/10.1037/14341-004>
- Yan, Y., & Bissell, K. (2014). The globalization of beauty: How is ideal beauty influenced by globally published fashion and beauty magazines? *Journal of Intercultural Communication Research*, *43*(3), 194–214. <https://doi.org/10.1080/17475759.2014.917432>
- Zamariola, G., Cardini, F., Mian, E., Serino, A., & Tsakiris, M. (2017). Can you feel the body that you see? On the relationship between interoceptive accuracy and body image. *Body Image*, *20*(Suppl. C), 130–136. <https://doi.org/10.1016/j.bodyim.2017.01.005>
- Ziemke, T. (2003). What's that thing called embodiment? In R. Alterman & D. Kirsh (Eds.), *Proceedings of the 25th Annual meeting of the Cognitive Science Society: Part 2 of 2* (pp. 1305–1310). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.