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She's Got Legs: Longer Legs in Female Comic Book Characters Correspond to Global Preferences

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Previous studies have shown that comic book bodies are supernormal stimuli, exaggerated in dimensions that are attractive to primarily male comic book consumers. Following the same methodologies as previous experiments, this study examined height and leg length measurements of comic book characters in both Marvel and DC comics. In accordance with the literature on leg length and attractiveness, we predicted that comic book women would have longer legs than comic book men and would have longer than average legs, matching preferences shown in cross-cultural studies. We also hypothesized that comic book women would be depicted as wearing heels or walking on tiptoe more often, as this further elongates the legs. Results showed that female comic character leg length matched the most common preferred leg length in cross-cultural studies and 86%–88% of female characters were drawn as either wearing high heels or walking or standing on tiptoe.

Public Significance Statement
This work furthers the study of popular culture products and how they reflect the evolutionary preferences of their target audiences. In this case, comic book women are drawn with elongated legs and in heels and on tiptoe to further lengthen their legs, which men prefer. This creates exaggerated and hypersexualized depictions of women that can influence both male and female perceptions of normal body types.

Keywords: leg length, comic books, DC, Marvel, high heels, female bodies

Recent research studied popular culture products, particularly depictions of human bodies, and mapped those physical features onto the mate preferences of the target audience (Burch & Johnsen, 2020; Burch & Widman, 2021; Lassek & Gaulin, 2016, 2019). Burch and colleagues measured shoulder-to-waist (SWR) and waist-to-hip ratios (WHR), as well as height, weight, and body mass index in comic book characters, while Lassek and Gaulin examined WHR in imaginary women in several pop culture products including video games, comics, and cartoons. These studies found that male comic book characters had extreme upper body muscularity (Burch & Johnsen, 2020; Burch & Widman, 2021) while comic book women had low weight and very small WHRs (Burch & Johnsen, 2020; Burch & Widman, 2021; Lassek & Gaulin, 2016, 2019). Each of these products targeted young men as an audience and exaggerated the bodily features men prioritized (but see cultural differences in WHR preferences; Cashdan, 2008; Sugiyama, 2004). Comic books, and particularly superhero comics, have a primary consumer market of young men (79% of superhero comics are sold to men 17–54 years old, Alverson, 2017).

Comic Book Bodies

Burch and Johnsen (2020) examined height and weight in over three thousand Marvel Comics characters and found men were on

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average obese, while women were at the low edge of normal weight. However, while these men possessed "obese" body mass indices; they actually had extreme upper body muscularity with SWRs of 2.18. Women, while being very thin, were simultaneously curvy with WHRs far below the typical human average. To expand on this study, Burch and Widman (2021) examined Marvel Comics, DC Comics, actual champion male bodybuilders, the most searched for women in online pornography, and a nationally representative sample of Americans. They found male characters had more variation in size, but Marvel men were bigger (in weight and SWR) than DC men. However, both were comparable, or bigger than, professional bodybuilders and much bigger than the average American in terms of SWR. Comic book women, on the other hand, were uniform in terms of height and weight across comic book brands (there was very little variance from the 5 foot, 7 in., 134 pound average), but DC women had smaller WHRs and comic book women overall had smaller WHRs than the globally most sought after women on Pornhub.com. US women could not compare, with their average WHR similar to the maximum WHR in the comic book sample. Lassek and Gaulin (2016) also examined fictional female bodies but expanded the types of media to include cartoons, comics, video games, and others as they asked participants to nominate "imaginary" women. In this sample, the WHR, and therefore attractiveness, was mostly influenced by differences in waist size. While hip size stayed relatively uniform, waist size was found to be the key determinant of female body attractiveness.

These studies indicate that when popular culture products are marketed to young men, depictions of fictional characters shift to exaggerate male body preferences; men become hypermasculinized and muscular, women become hyperfeminized and thin yet curvy. Essentially, both sexes become hypersexualized. While this work is fascinating, it has primarily focused on WHR in women and SWR in men. There are still other bodily features to be measured and compared. Given that superhero comic books are primarily targeted at men under 50 (Alverson, 2017) and depict thousands of bodies, they make a good candidate to examine other male preferences, like hair length, breast size, feature proportions, or in this case, leg length.

Leg Length

Although some researchers argue otherwise (Swami et al., 2007), women usually do not have proportionally longer legs than men. Several post-pubertal studies have found that women have slightly shorter legs (Martin & Nguyen, 2004; Sorokowski & Pawlowski, 2008). Sorokowski and Pawlowski (2008) report this in some detail with multiple studies showing post-pubertal boys and men having longer legs and shorter trunks than women (Dangour et al., 2002; Eveleth, 1978; Martorell et al., 1988) Among 18 year olds, the mean subischial leg length to stature index is 0.472 for boys and 0.465 for girls (Sorokowski and Pawlowski's calculations from data of Dangour et al., 2002). They also report that the mean index in the Polish population of height to perineum/total height is 0.516 for men and 0.513 for women and in their own sample, this ratio is .50 for men (range of .46–.53) and .49 for women (.41–.54). In a Dutch sample, Fredriks et al. (2005) reported that 21-year-old men had a sitting height to standing height ratio (an estimate of subischial leg length) of 0.513 and 0.526 for 21-year-old women. This would result in a subischial height ratio of 0.487 for men and 0.476 for women. In contrast to these data, preferences are widely shown to be for longer legs in women than men.

Generally, legs influence women's sexual attractiveness more than men's; men value longer legs in women more than women value longer legs in men. Montoya (2007) found that legs were more important in men's evaluation of women's overall body attractiveness (in third place out of 21 physical characteristics assessed by men) than in women's evaluation of men's attractiveness (16th of 21 physical characteristics assessed by women). Because of individual variation in height, most measures of leg length are calculated as a percentage of overall height, or the leg-to-body ratio (LBR). Studies showed average or slightly higher than average leg length increases ratings of women's attractiveness (Bertamini & Bennett, 2009; Prantl & Gründl, 2011; Sorokowski et al., 2011; Sorokowski & Pawlowski, 2008), but preferences for male leg length are far more ambiguous with little consistency across studies (Sorokowski et al., 2011). Prantl and Gründl (2011) in a sample of 34,000 men and women found that 54% favored a leg

length that if a woman's body height was 170 cm (5 foot, 7 in.), would correspond to a leg lengthening of 6 cm (2.36 in.), a difference that corresponds to the average height of high-heeled shoes.

Sabiniewicz et al. (2015) found a developmental trajectory of the preference for longer legs. In a sample of 3–20 year olds, the authors found the preference for average leg length in three-dimensional figurines emerged at approximately 9 years of age, and the preference for longer than average legs emerged at 15 years for both sexes. It is possible that the trajectory of this preference, because it coincides with puberty and adolescence, is reflecting endocrine and other physiological changes and indicating an adaptation linked to reproductive functioning in the rater. Sabiniewicz et al. (2015) state, "changes in preferences, especially concerning longer legs, may result from increased activity of steroid hormones, organizing teenagers' preferences towards more sexual shapes" (p. 533).

Research on various artistic depictions of the human body throughout history found that while the ideal leg length in women has increased over time (that modern attractive women have longer legs than attractive women in history), the preference for male leg length has not shifted (Sorokowski, 2010). Some may view the shift over time and developmental changes as cultural or environmental factors leading to this preference, and it has long been believed that long legs as a sign of beauty is a part of Western cultures in particular (Sorokowski et al., 2011). In addition, cultural differences have been found (Swami et al., 2007) such as in traditional cultures like the Himba, where the preference for long legs is in men, not women (Sorokowski et al., 2012). However, a study of 27 different countries found culture of origin had little effect on leg length preferences (Sorokowski et al., 2011). In Europe, Canada, Africa, and Asia, attractiveness ratings for LBR peaked at .541, for Latin America, it peaked at .515. Sorokowski (2010) measured the leg length of historical artworks and figures and found that while overall prevalence for slightly longer legs in women has increased over time, they have been constant since the Renaissance. This change in depictions of leg length, however, may be due to increases in both food security and health during the Renaissance in Europe (Crosby, 2003). This would be consistent with changes in preferences for WHR with changes in food security (Pettijohn & Jungeberg, 2004; Saxton et al., 2020; Swami & Tovée, 2007).

As with many physical preferences in humans, leg length can also be an indicator of health; particularly in cases of malnutrition or illness during development. Leg length has been negatively related to early childhood illnesses and malnutrition, lower early-life socioeconomic status, and increased risk of various illnesses (see Bogin & Varela Silva, 2010, for review). Kiire (2016) found that leg length was positively related to breastfeeding and energy intake at age four. Longer leg length is associated with various life outcomes including reduced risk of coronary heart disease, diabetes resistance, low blood pressure, better cardiovascular profiles, and reduced risk of cancer (Gunnell, May, et al., 2003; Gunnell, Whitley, et al., 2003; Langenberg et al., 2003; Smith et al., 2001). Corresponding to the emerging preference for long legs in adolescence, female leg length also appears to be related to reproduction, with women with shorter legs exhibiting lower reproductive capabilities (Wadsworth et al., 2002).

Overall, the research indicates preferences for longer than average leg length, particularly in female leg length (Sorokowski, 2010; Sorokowski et al., 2011), are responses to the health and reproductive markers that longer legs (but not extremely long legs) display (Gunnell, May, et al., 2003; Gunnell, Whitley, et al., 2003; Langenberg et al., 2003; Smith et al., 2001; Wadsworth et al., 2002). These findings imply that the preference for longer female legs is adaptive, and that this preference would be expected in men ages 17–54 years, the primary audience for superhero comic books. Given the research showing that comic book body depictions reflect male preferences and the hypothesis that men prefer women with longer legs, we predict that women in comic books would have longer than average legs, while comic book men would have average leg lengths, matching the cross cultural studies on leg length (Sorokowski et al., 2011).

Study 1

Method

This study only examined comic books and their depictions of humanoid characters.

Human actors in film or television, animated series characters, and depictions for other media, such as children's books, were not selected. Animals (or half animals), children, apparitions, robots, and other entities were also removed. For bodily measurements, internet image searches were conducted for comic book panels depicting characters listed in the DC and Marvel Comics rosters (see Burch & Widman, 2021). Only images from DC and Marvel Comics (comic panels, licensed advertisements or merchandise, trading cards, posters, etc.) were selected. Images from other media (film, television, animation), or unlicensed/fan art were not used. If a verified comic panel or image met the criteria for a given body measurement (see below), it was added to the sample. Depictions were selected with no consideration of date of creation or publication; therefore, depictions were taken from various eras but not with a purposeful representation of all eras.

Bodily Measurements

Drawings and comic book panels of adult characters from both Marvel and DC were pulled from online official comic wikis and indexes (e.g., Marvel.com) as well as alphabetical image searches for popular characters. Overall, the collection of stimuli for various bodily features included over 3,000 images. Stimuli were selected from the collection on the following criteria: full body from an eye-level angle (e.g., no drawings from overhead or below) in a standing position with legs fully extended. Measurements from the top of the head (not top of hair), waist (narrowest point of waist), perineum or base of pelvis, and bottom of heel (not bottom of shoe or tip of toe) were taken to calculate the full height, percent of total height from waist-to-heel (iliac height) and percent of total height from perineum to heel (subischial height). Therefore, depictions were required to have each of these points visible and extended legs were chosen for measurement. Using physiological markers like the umbilicus was not possible, as not all drawings possessed this amount of detail. Because of these various criteria, this sample selection was not random. Each depiction/picture was a separate case, and some characters could have multiple depictions in the sample. This resulted in a total of 559 depictions of 525 characters. Of these depictions, 293 were DC (183 male, 110 female) and 266 were Marvel (142 male, 124 female). Given the different sizes of panels, measurements were made in pixels using photo editing software Microsoft Paint and Microsoft Paint 3D. Two research assistants blind to the hypotheses measured the stimulus photos and measurements were spot checked (every 10) by the first author for accuracy in both placement (see above) and measurement.

Given the research on leg length in attractiveness in humans, and the research on comic book characters as supernormal stimuli, we predicted that comic book characters would have longer legs (as a percentage of full height) than human samples. In addition, female comic book characters would have longer legs than male comic book characters and typical human women.

Results

The two proportionate measures of leg length, the iliac height and the subischial height, are shown in Table 1 for each brand and sex. Examination of these means suggest that women's character's leg length, regardless of how measured, is consistently greater than male character's leg length, with female character's leg length ranging from 103% to 108% of the male character's.

The proportions were analyzed using ANOVA with sex (male vs. female) and brand (Marvel vs. DC) as factors. ANOVA on the subischial length proportion revealed a significant main effect of sex, $F(1,\ 540) = 63.66,\ p < .001,\ \eta_p{}^2 = .105$, and a significant interaction of sex and brand, $F(1,\ 540) = 9.91,\ p = .002,\ \eta_p{}^2 = .018$. The main effect of brand was not significant, $F(1,540) = 0.57,\ p = .45$. Post hoc Tukey's HSD tests on the interaction revealed that while the DC males and the Marvel males did not differ, all of the other means did differ from each other. Cohen's *d*s for the significant Tukey's HSD comparisons ranged from $d = 0.34$ to $d = 0.97$.

ANOVA on the iliac height revealed significant main effects of both brand, $F(1,\ 555) = 16.07,\ p < .028,\ \eta_p{}^2 = .105$, and sex, $F(1,\ 555) = 136.09,\ p < .001,\ \eta_p{}^2 = .197$, but not a significant interaction, $F(1,555) = 0.13$, $p = .72$. As can be seen in Table 1, female comic book characters had greater iliac height as a percentage of overall height relative to men

Table 1
Means and Standard Deviations for the Subischial and Iliac Leg Length as a Proportion of Total Height for the DC and Marvel Characters of Both Sexes

	Subischial						Iliac					
	Male			Female			Male			Female		
Brand	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*
DC	171	0.498	0.042	108	0.514	0.044	183	0.613	0.041	110	0.648	0.042
Marvel	142	0.489	0.037	123	0.528	0.034	142	0.624	0.031	124	0.622	0.028

and Marvel characters had the greater iliac proportion than DC characters.

Discussion

These measures of comic book bodies map onto the established cross-cultural preferences for greater than average LBR in women and average LBR in men. Compared to studies on actual humans, comic book women were above typical human measures. As stated previously, cross-cultural studies on human subischial leg length preferences report peak preferences of .541 for Europe, Canada, Africa, and Asia, and .515 for Latin America (Sorokowski et al., 2011). Female comic book characters were measured at .521, in between those peak preferences. Comic book depictions of men were drawn with leg lengths similar to the average for actual people (.494). In fact, the average for comic book men was less than several reported subischial LBRs (Sorokowski & Pawlowski, 2008).

To illustrate this in "typical" comic book characters, comic book men are on average 73 in. tall (Burch & Johnsen, 2020; Burch & Widman, 2021), resulting in a perineum to heel leg length of 36.06 in. For women, the typical height is 67 in., resulting in a perineum-to-heel leg length of 34.91 in. If we use Sorokowski and Pawlowski's (2008) leg length percentage of .490, leg length would calculate to 32.83 in.; the difference between this and the comic book women's measured leg length is 2.08 in. This is similar to Prantl and Gründl's (2011) increase of 2.36 in. when measuring preferences for female leg length. To interrogate the sample more closely, we examined the demographics of the top and bottom 10% of the sample. In the bottom ten percent of leg length cases ($M = .426$, $SD = .031$), we found that the majority were men (72.2%), with an even split (50.0%) between heroes and villains. In contrast, the top ten percent of the sample ($M = .582$, $SD = .033$) consisted of 73.1% female characters and 68.4% heroes. This maps onto the findings of Burch and Johnsen (2020) as men had greater variance in shape and size for both heroes and villains. Women, by contrast, were far more uniform and those who were outside the norm (overweight, unattractive, etc.) were more likely to be villains and in this sample, the longest (presumably most attractive) legs belonged to women and heroes. This is a possible avenue for future research.

In collecting these measurements, it became apparent that measuring leg length from perineum to toe (e.g., Prantl & Gründl, 2011) was not possible. Not only were feet drawn in various positions that would make measurement difficult, we noticed female characters were drawn in different positions than men. Women were more often drawn in heels or walking/standing on tiptoe, regardless of context. Because of this, this study measured legs from perineum to heel, and therefore leg lengths would be even longer if measuring perineum to toe was possible. This raised the question of how frequently women are depicted in heels or on tiptoe. To answer this question, we conducted study 2.

Study 2

It should come as no surprise that women may accentuate or elongate their legs with the use of high-cut clothing and high-heeled shoes. Prokop (2022) found sexual attractiveness ratings of legs correlated with perceived leg length, legs were perceived as longer with high-heeled shoes, legs with high heels were perceived as more sexually attractive than legs with flat-soled shoes, and women in high heels were seen as more sexually receptive. In addition, when women

imagined interaction with an attractive man, preferences for high heels steeply increased compared with a scenario with an unattractive man. Wade et al. (2022) found that women in high heels were perceived as being more sexually attractive, physically attractive, feminine, and of higher status by both men and women.

Lewis et al. (2017) argue that the changes in evaluations of attractiveness are not due to the heel itself, but rather seeing a woman's altered body shape, particularly her lumbar curvature. This creates an interesting question for comic book depictions, as bodies can be drawn in any position or shape; high heels are not needed to change a fictional woman's lumbar curvature, so why would comic book depictions need to include them? It is also important to remember that Prantl and Gründl (2011) found preferences for leg length in women were equivalent to actual leg length plus the height of high heels, so heels may also be drawn to give the appearance of elongating the female characters' legs, even though artists can draw them as long as they wish. However, given the perceptions found in Wade et al. (2022) and Prokop (2022), we would expect that heels still convey sexual attractiveness and femininity, something comic books exaggerate in their depictions (Burch & Johnsen, 2020; Burch & Widman, 2021). Based on the research on high heels and leg length, we predict that the vast majority of comic book women would be depicted wearing heels or walking on tiptoe when wearing flats or barefoot, regardless of context.

Method

A separate dataset was created compiling all of the depictions of legs and feet as well as additional depictions collected from comic book covers and panels. Once again, drawings and comic book panels of adult characters from both Marvel and DC were pulled from online official comic wikis and indexes (e.g., Marvel.com) as well as alphabetical image searches for popular characters. The criteria were as follows: character must be in a standing or walking position with feet visible. Because this sample focused on costumes, not body measurements, multiple depictions of the same character could be collected as long as costumes differed. A total of 1,016 depictions (of 812 characters) were collected (433 male, 583 female) from both DC and Marvel (480 DC, 536 Marvel).

We predict that women would be depicted as wearing heels more often than men, that the majority of depictions of women would be drawn in heels, and if not depicted in heels, women would be depicted on tiptoe, to further enhance their leg length.

Results

Table 2 shows the frequency of characters only wearing high heels and only standing on tip-toe for male and female DC and Marvel characters. Due to the small number of frequencies in some categories, we combined both the high heel and tip-toe conditions for the purposes of analysis into either high heels or tiptoe category. A logistic regression model was constructed for the variable either heels or tiptoe with comic brand and character sex and the interaction as factors entered simultaneously. The DC female was selected as the reference category as we have shown that DC females are depicted as more feminine based on waist-to-hip measurements (Burch & Widman, 2021). The goodness of fit chi-squared test indicated that the model did fit the data well, $\chi^2(1012) = 651.1$, $p < .001$. Further, the accuracy (.872), sensitivity (.933) and specificity (.807) metrics also suggested a good fit. Table 3 shows the standardized β weights, the standard errors of the weights, the odds ratios, and the Wald χ^2 statistics for each factor in the model. Examination of the table reveals that the main effect of character sex was significant while the main effect of brand was not. However, there was a significant interaction between brand and character sex. The probabilities of each outcome based on the β weights, depicted in Table 4. These revealed that the probability of a DC female (.937) being depicted in high heels or on tiptoe was greater than for a Marvel female (.822). DC men had a greater probability of being depicted as wearing high heels or standing on tiptoe than Marvel men. The interaction between brand and character sex is most probably due to the greater difference between the DC and Marvel men compared to the difference between the women.

A pattern appeared during this analysis; female characters who were depicted as "flat-footed" were frequently subadult (either juvenile or pubescent). In total, 22 subadult girls were

Table 2
Frequency of Depictions of Male and Female Characters from DC and Marvel Comics Portrayed Wearing High Heels or Standing on Tip-Toe

		Heels alone		Tip-toe only		Either heels or tip-toe	
Brand	Depicted	Male	Female	Male	Female	Male	Female
DC	Yes	1	166	22	56	23	222
	No	210	103	189	213	188	47
	Percentage yes	0.5	38.3	10.4	21.2	10.9	82.5
Marvel	Yes	0	127	12	139	12	266
	No	222	187	210	175	210	48
	Percentage yes	0.0	40.4	5.4	44.3	5.4	84.7

found in the "flat-footed" category (11 for DC and 11 for Marvel). When these subadult women were removed from the sample so that it only consisted of adult women, the percentage depicted as either in heels or on tiptoe increased to 86% for DC and 87.8% for Marvel (approximately six out of seven women for DC and seven out of eight women for Marvel). We examined the LBR of this subsample and found that the average subischial leg length for subadult women was .491 ($SD = .035$).

Discussion

As can be seen in Table 3, the logit model predicts that the odds of selecting a male character wearing high heels or standing on tiptoes from our sample are very small, 2.6% relative to selecting a female character wearing high heels or standing on tiptoe. Women were drawn on tiptoe when barefoot, in costume stocking feet, and even when wearing other types of shoes or boots. Additionally, we see that the difference observed by Burch and Widman (2021) in the greater sexualization of DC women in WHR persisted here in the extension of the leg length through the feet. DC women were more likely to be portrayed as wearing high heels or standing tiptoe than Marvel women.

While we expected that men would not be depicted in high heels, as that is not the cultural norm, men were also depicted on tiptoe in very small percentages (one out of 10 for DC, one out of 20 for Marvel). The difference we see in the probabilities of either wearing high heels or being on tiptoes is consistent, however, with the results of the SWR found by Burch and Widman (2021). Here, they also found that DC men were slightly less masculinized in their SWR just as they are more likely to be depicted wearing high heels or standing on tiptoes.

Further, this discovery that approximately 23% of female characters who were depicted as "flat-footed" were often subadult needs more exploration. This supports the idea that long legs and heels are used to increase the sexiness of female characters. Young women in comics are far less sexualized; they are drawn with juvenile bodies and fully clothed, unlike the extremely curvy adult women in minimal clothing (Burch & Johnsen, 2020; Burch & Widman, 2021). While high heels might not be seen as appropriate in subadult women,

Table 3
Result of Logistic Regression on Whether the Comic Character Was Wearing High Heels or Standing on Tiptoe With DC Female Characters Depictions as the Reference

Factor	Estimate (*SE*)	Odds ratio	Wald	*p*
Intercept	1.55 (0.161)	1.17	0.5076	.477
Brand	0.16 (0.224)	1.17	0.5076	.477
Character sex	−3.65 (0.273)	0.026	18.98	<.001
Interaction	−0.92 (0.433)	0.398	4.53	.033

Note. The odds ratio indicates the chances of selecting a character with different characteristics (character sex or brand) from the reference character.

Table 4
Probability of Whether a Character From DC or Marvel Is Wearing High Heels or Standing Tiptoe by Character Sex

Brand	Male	Female
DC	.000002	.937
Marvel	.0000003	.822

explaining the results in high heel depictions, the average LBR for the subadult women was .491, well below that of adult women. Interestingly the heights given to these characters by their respective creators is an average of five foot, six and one-half inches (66.5 in./168.9 cm), close to the average height of all women in Marvel and DC (67.5 in./171.4 cm; Burch & Widman, 2021).

General Discussion

These findings further support the growing literature on hypersexualization in fictional characters. Not only are comic book women drawn as having longer legs than comic book men and actual human women, their legs are further extended by being drawn in heels or on tiptoe. While this does cause some methodological issues for measuring comic book legs, it provides another example of how adult female characters are depicted in ways that increase their attractiveness to male readers. Women's legs were longer and matched cross-cultural preferences even before they were extended by high heels or tiptoe, and neither of these conditions are necessary as artists can draw women's legs as long as they want. In addition, these conditions, even in imaginary worlds, are highly impractical. Once again, various features of comic book characters are hypersexualized, not for any functional reason, but to create supernormal stimuli for male consumers.

What is particularly interesting about these findings is that even though the physical features being measured were quite different from muscularity and curvaceousness, they largely mapped onto the findings of previous studies regarding character sex and brand. First, we see that the brand effects observed in Burch and Widman (2021) are similar to the leg-extending conditions reported here. Just as with SWR, we found that the DC men were less masculine by being more likely to be either wearing high heels or on tiptoe than the Marvel men. DC and Marvel men, however, do not differ significantly in height as reported by their respective creators (Burch & Widman, 2021). We also observe that the DC women were more feminized with greater depiction in heels, consistent with the previously reported WHR. The results of the leg length by itself, however, are different; here we see that the Marvel characters are more sexualized than the DC characters; male leg lengths were shorter and female leg lengths were longer. However, leg length measurement procedures had to be modified in this study precisely because of the high heels; while Marvel women are drawn with longer legs (to the heel), DC women are more often drawn in high heels, which would give the illusion of longer legs. This difference is interesting (as was mentioned previously) because these women can be drawn in any way the artist wants including with longer legs and heels, creating an extremely long legged depiction. However, it appears that artists choose one or the other and therefore avoid extremes.

Strengths and Limitations

Taken together with previous work by Burch and Johnsen (2020) and Burch and Widman (2021), this body of work provides more measurement and analysis of hypersexualization in comic books than in this history of this topic. Previously work only provided subjective measures (Avery-Natale, 2013) or studied only a particular type of character (Da-Silva et al., 2014). Likewise, previous work has only worked with small samples of characters or depictions (Avery-Natale, 2013; Young, 1991). This body of work has utilized data on thousands of characters and depictions in various positions from various decades. Given that DC and Marvel make up the majority of the comic book market (Alverson, 2017), this work useful in size, scope, and specificity.

Even with this progress, given the enormous number of brands, characters, and depictions, this sample is still a very small percentage of images that can be measured and analyzed. In addition, while this study collected images from the two primary comic book publishing houses, DC and Marvel, which compose over 60% of the comic book market (Alverson, 2017), depictions of characters may vary with other brands. In terms of methodology, anthropometric measures of comic book bodies can only be estimated in pixels, as these are two-dimensional drawings, but we did follow the practices of human studies as closely as possible. In addition, while the methodological issues regarding foot position led us to interesting findings regarding high heels, tiptoe, and leg elongation, these are still issues that cause our measurements to be minimal estimates of leg

length in comic book women. Future studies may benefit from restricting the criteria for comic panels, for example, only selecting women who are flat-footed to get more accurate measures. However, as these findings show, this would be a very specific subset of women and would often include subadults, which creates other methodological issues.

Future Work

Just as Lassek and Gaulin (2016) solicited nominations of female characters from a number of media platforms for their study on waist-to-hip ratio, it would be interesting to follow their methodology and measure the leg-to-body ratios of women in cartoons, comics, video games, graphic novels, and other popular culture products. It would also be interesting to see if leg length changed with the target audience of said product. Another area for further research would be the role that the character plays in their respective medium. Burch and Johnsen (2020) commented that while men had a much larger variance in size and shape and in hero/villain categories, women were relatively uniform in body shape and size in Marvel Comics and women who were outside this norm were more likely to be villains. Essentially, a woman could have a sexy body and be a villainess, but a woman with a different body (overweight, old, etc.) was rarely a heroine. Leg length according to hero or villain status, or according to primary or secondary character, would be an interesting avenue to explore, along with other bodily measures like SWR or WHR. As we have already seen, the lowest ten percent of LBR measurements were 72.2% male, with an equal ratio of heroes to villains. This is to be expected as men have a much larger variance in size and shape. The data on female leg length and hero/villain status should be studied in more detail, although this is far more difficult as so few women are outside the norm (Burch & Johnsen, 2020).

Implications

One of the implications for this work is that this hypersexualization, while desired by readership, in turn creates unrealistic depictions and expectations of both male and female bodies. If women depicted in comic books are routinely and uniformly depicted as thin, curvaceous, and long-legged, and men as extremely muscular (at times beyond human limits), this may impact both expectations in partner attractiveness and self-esteem regarding the readers' own appearance. Added to this is the observation that characters that do not reach hero status are overweight, shorter, or less muscular. Taken together, readers are shown unobtainable physical goals and also that these features are markers of character.

That these depictions from western media can have influences on people is well documented (Becker et al., 2002, 2011; Devine et al., 2022). Frederick et al. (2022) found that women were preoccupied with maintaining a weight within societal parameters. Their appearance priorities were linked to weight loss more than other features. Both Burch and Johnsen (2020) and Burch and Widman (2021) found that variation in female bodies was very small, and overall, that female comic characters were close to underweight body mass indexes. Frederick et al. (2017) showed women images of models and then asked them about bodily features they viewed negatively. The top three features these women had negative feelings toward were their stomachs, weight, and waists (in that order). Male comic characters were given far more variation in shape and size. However, in order to be a hero, male muscularity was the norm, particularly upper body muscularity (Burch & Widman, 2021). Frederick et al. (2007) found male body satisfaction was more strongly linked to muscularity, and US men's muscularity preferences were associated with concepts of masculinity. By giving consumers what they want to see in terms of heroes and heroines, comics are also creating negative views of actual human bodies. As Burch and Widman (2021) showed, actual humans do not measure up to these fictional bodies. The current study widens this disparity as comic book women have longer legs, a feature that no amount of diet or exercise can attain.

Comic books can, and should, be included among the various media that people are exposed to that can shift their body image. Given that the majority of readers of superhero comics are male, this would provide a focus on male body image and dissatisfaction regarding particular features (e.g., Pope et al., 1999). Given the massive proliferation and impact of superhero films, it is also important to examine the effect of comic books on film depictions and the depictions of

both on consumers. Burch and Johnsen (2020) made it clear that the actual human actors portraying superheroes could barely reach minimal comic book measurements, even with considerable training and restricted diet. They also mention that costume designers for these supersuits create additional muscles, commenting that actual humans cannot attain this stature. In sum, comics have hypersexualized bodies for decades, but they have never had this many iterations, or this much global impact, before. Research on how this affects body image is needed.

Conclusion

In conclusion, just as with WHR and SWR in comic book characters, leg length maps onto younger male preferences, the product's primary audience. Moreover, this preference for longer legs is rooted in evolutionary strategies to seek out and prefer markers of health and reproductive viability in women. The findings of this study, along with previous work on other bodily features may have significant implications for body image and expectations.

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