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The Supernormal Stimuli of Sex Dolls: A Novel Source of Evidence for Men's Unconstrained Mate Preferences

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The design of sex dolls—unconstrained by biological limitations—offers a unique window into human mate preferences and contributes a novel source of evidence toward several debates in evolutionary psychology. First, do men's preferences align more closely with cues of nubility rather than current fertility? Second, are men primarily attracted to a slim waist rather than a low waist-to-hip ratio per se? Finally, do sex dolls, like other artificial depictions of the female form, exhibit dimensions that enter the realm of supernormal stimuli? Drawing on a publicly available data set of 793 sex dolls, this study tests these hypotheses. Results show that sex dolls have significantly lower waist-to-hip ratios ($M = 0.62$) than real women ($d = 3.23$), supporting the nubility hypothesis. Sex dolls exhibit 52% more variability in hip size than waist size, and waist size remains stable across bust increases, while hip size scales up more proportionally. This suggests that waist narrowness, specifically, is a nonnegotiable feature in sex doll design. Compared to male sex dolls, female sex dolls have small feet relative to height, again consistent with the nubility hypothesis. Almost half of female sex dolls have breast cup sizes E–O, which far exceeds the natural range observed in real women, further supporting the hypothesis that men's mate preferences, when unconstrained, extend into supernormal stimuli. Contrary to predictions, both male and female sex dolls were significantly shorter than their human counterparts, perhaps indicating that logistical constraints, rather than mate preferences, influence height proportions in sex doll design.

Public Significance Statement
This study reveals that sex dolls, designed with exaggeratedly feminine traits such as an exceptionally low waist-to-hip ratio, provide a novel source of insight into men's mate preferences. The findings highlight how artificial intimacy reflects men's desires, offering both potential risks of perpetuating unrealistic beauty standards and opportunities for reducing sexual loneliness.

Keywords: sex dolls, evolutionary psychology, mate preferences, waist-to-hip ratio, supernormal stimuli

Few phenomena better illustrate the evolutionarily novel nature of the modern mating environment than the concept of artificial intimacy—the use of technology to simulate emotional or sexual connections (R. Brooks, 2021; Goetz et al., 2019). One compelling example is the development and use of sex dolls, that is, material representations of the human body designed for sexual use (Ferguson, 2010). Unlike sex toys, which emulate specific parts of the body, sex dolls largely replicate the full human form. These dolls can be tailored to specific

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preferences, including sex, breast size, and waist-to-hip ratio (WHR).

Sex Dolls as an Ecologically Valid Window Into Men's Mate Preferences

Sex dolls offer a unique window into male mate preferences, as they bypass biological constraints, fulfill fantasies, and eliminate the need for reciprocal partner selection. By allowing customers to dictate exactly which qualities their dolls should embody, they offer valuable insight into the underlying structure of these preferences. Their unconstrained nature also makes sex dolls an ideal case study for addressing three key questions in evolutionary psychology: (a) Do men prefer cues of nubility or current fertility? (b) Is WHR or absolute waist size the more salient cue of female attractiveness? and (c) Do sex dolls, like other unconstrained depictions of female beauty, exaggerate naturally occurring features to the point of becoming supernormal stimuli? Before turning to these questions, I will first outline the evolutionary logic underlying male mate preferences.

The Evolution of Male Mate Preferences

To understand mate preferences, one must examine the ancestral selection pressures that influenced their development, and the resulting design of their information processing architecture (Symons, 1979). Ancestral humans who possessed psychological mechanisms that (a) attended to cues in a potential mate that were predictive of positive fitness consequences of mating with that individual and (b) generated preferences for mates exhibiting these cues, would have out reproduced their counterparts who lacked those preferences. In short, these preferences conferred fitness advantages, leading them to become universal species/sex-typical traits.

As fertility is sharply age-graded and not directly observable in women, our male ancestors relied on observable cues correlated with reproductive potential (Symons, 1979; G. C. Williams, 1975). This principle forms the foundation of an evolutionary theory of female beauty, first proposed by Symons (1979) and later developed by Buss (1989) and Buss and Schmitt (1993), which suggests that men evolved preferences for traits reliably indicating reproductive value.

Men's Preference for a Low WHR

A commonly idealized WHR is approximately 0.70, that is, a waist circumference 70% of the hip circumference (Singh, 1993a, 1993b). This preference is observed cross-culturally, including in the United Kingdom, Australia, Germany, Greece, India, Guinea-Bissau, and the Azores (Connolly et al., 2004; Furnham et al., 1997; Singh et al., 2010; Swami, Antonakopoulos, et al., 2006; Swami, Caprario, et al., 2006).

Myriad empirical studies using diverse methodologies such as line drawings (Singh, 1993a, 1993b), three-dimensional (3D) body scans (Brown et al., 2008), brain activity analysis (Platek & Singh, 2010), eye-tracking studies (Dixson et al., 2011; Garza et al., 2016), adaptive memory recall studies (Fitzgerald et al., 2016), analyses of female escorts (Saad, 2008) and porn stars (Salmon et al., 2020), cosmetic surgery procedures (Singh & Randall, 2007), Miss America winners, Playboy models, and plus-size models (Aung & Williams, 2018; Bovet & Raymond, 2015; Lassek & Gaulin, 2016) all support men's consistent preference for a low WHR. Venus figurines from 20,000 years ago also indicate a deep evolutionary history of WHR preferences (King, 2013). Remarkably, even congenitally blind men prefer low WHRs when assessing female body shape through touch (Karremans et al., 2010).

Do Men Prefer Cues of Current Fertility or Nubility? An Ongoing Debate

Although there is abundant evidence for the male preference for a low WHR, the precise adaptive rationale is less clear. According to a systematic review, WHR has been hypothesized to be linked to as many as 42 fitness-related variables (Bovet, 2019). Two competing hypotheses, whether men prefer cues of nubility or cues of current fertility, frame a key debate in human attractiveness research.

For clarity, the term current fertility here refers to the idea that men prioritize cues of immediate conception likelihood. Nubility refers to the developmental phase following menarche but preceding first pregnancy, when a woman's remaining reproductive lifespan is at its peak (Symons, 1979). In well-nourished populations, this corresponds to ages 15–19 (Ellis, 2004). A woman in her mid-to-late 20s may be at peak fertility, meaning her immediate conception likelihood is

highest, but her nubility is already declining as her remaining reproductive years decrease and the likelihood of prior pregnancies increases (Conroy-Beam & Buss, 2019).

The Current Fertility Hypothesis

The idea that men are attracted to low WHRs was first popularized by Singh (1993a, 1993b), who proposed that a low WHR serves as a "first-pass filter" in assessing women's mate value. This hypothesis is compelling because a low WHR is a sexually dimorphic trait that emerges at puberty (Wells, 2007), and a low WHR has also been linked to several indicators of reproductive potential. These include the onset of menarche (Lassek & Gaulin, 2006, 2007) and regular menstrual and ovulatory cycles (Morán et al., 1999; van Hooff et al., 2000). WHR is also associated with reproductive capacity independent of overall body fat levels (Zaadstra et al., 1993), and the classic hourglass figure tends to diminish with age and menopause (Kirschner & Samojlik, 1991). Women with a low WHR and larger breasts show 26% higher estradiol levels, a key predictor of pregnancy success (Jasieńska et al., 2004). The idea that men favor low WHRs as indicators of female health and fertility has been broadly embraced in evolutionary psychology (see Sugiyama, 2015 for a review).

The Nubility Hypothesis

Alternatively, the nubility hypothesis proposes that men's attraction to a low WHR is driven not by immediate fertility cues, but by indicators of long-term reproductive potential (Symons, 1979, 1995). The adaptive rationale is as follows: (a) By selecting a nubile mate, a man capitalizes on her future reproductive potential, securing the opportunity to sire multiple offspring over her most fertile years; (b) younger women are more likely to have living kin who can provide additional support for offspring survival; and (c) in ancestral environments, a younger mother had a higher probability of living long enough for her children to reach maturity.

Recent findings also suggest that nubile primiparas (first-time mothers in the nubile age range) have significantly better reproductive outcomes than slightly older first-time mothers. A large-scale study of 1.7 million first births in the United States found that women aged 16–20 experienced lower rates of life-threatening labor complications and higher fetal survival rates (Lassek & Gaulin, 2021). These results suggest that in ancestral environments, where surgical deliveries were unavailable, men who selected younger, nulliparous mates may have increased their reproductive fitness by securing partners more likely to have a successful first pregnancy and a surviving infant.

Men who were most strongly drawn to signs of nubility would have had an evolutionary advantage by securing long-term reproductive investment before rival males. In ancestral environments, postnubile women were typically already mated with children and engaged in ongoing reproductive commitments such as pregnancy or lactation, both of which suppress ovulation and reduce immediate fertility (Goetz et al., 2019; F. W. Marlowe, 2005; Symons, 1995). Men who primarily pursued women at their peak fertility in their late 20s would have faced limited mating opportunities, as such women were likely already unavailable. Selection would therefore have favored men especially attracted to indicators of nubility, leading to a species-typical male preference for youthful features associated with reproductive potential rather than current fertility (Symons, 1995).

The key distinction between nubility and current fertility is that nubility declines well before peak fertility is reached. The teenage years (the peak of nubility) are a well-documented period of low immediate fertility because of infrequent ovulation, whereas maximum fertility does not occur until the mid-to-late 20s (Apter, 1980; Ellison et al., 1987; Larsen & Yan, 2000; Loucks, 2006; Weinstein et al., 1990). Thus, if the nubility hypothesis is correct, the current fertility hypothesis must be incorrect.

There is substantial evidence supporting the idea that male preferences align with traits associated with female nubility (Symons, 1995). Even within a narrow age range of 18–26, younger female faces are rated as more attractive (Wheatley et al., 2014). Some studies even find a preference for faces younger than 15 (Fink et al., 2006; Jones et al., 1995; Röder et al., 2013).

Several other traits linked to nubility are also perceived as attractive, including lighter, more homogeneous skin (Feinman & Gill, 1978; Fink et al., 2001, 2006), fuller lips (Gunn et al., 2009; Sforza et al., 2010), and firm breasts that have reached adult size and shape but are not

yet unaffected by gravity or childbirth (Coe & Steadman, 1995; F. Marlowe, 1998). Higher-pitched female voices (a marker of youth, femininity, and estrogen levels) are rated as more attractive (Awan, 2006; Bryant & Haselton, 2009; Feinberg et al., 2008; Fraccaro et al., 2011; Haselton & Gildersleeve, 2011; Pipitone & Gallup, 2008). The nubility hypothesis also explains cultural variations in body fat preferences. In populations where nubile women have higher body mass indexes (BMIs) than older mothers because of maternal depletion, men tend to prefer higher BMIs as a local marker of nubility in those ecologies (Sherry & Marlowe, 2007; Sugiyama, 2015; Yu & Shepard, 1998).

Low WHR as a Cue of Nubility

A low WHR may serve as a particularly reliable cue of nubility because it reaches its lowest point during adolescence, before increasing with age and parity (number of pregnancies). During female puberty (approximately ages 10–18), body fat rises from about 12%–15% to 25%–26% of total body weight, with fat deposits shifting to the hips, buttocks, and thighs, which is a uniquely human trait that may have evolved to store essential fatty acids for fetal and infant brain development (Boot et al., 1997; Lassek & Gaulin, 2008; Lim et al., 2009; Taylor et al., 2010). This developmental trajectory suggests that low WHR functions as a salient visual marker of nubility.

Lewis et al. (2022) argue that the parity hypothesis (i.e., that low WHR indicates fewer previous pregnancies) is the strongest explanation for men's preference for a low WHR. As WHR increases with parity, a lower WHR may serve as a reliable indicator of greater remaining reproductive potential (Lassek & Gaulin, 2006). Cross-cultural research supports this claim: Women with fewer children consistently have lower WHRs (Butovskaya et al., 2017), suggesting that WHR reflects reproductive history in a visible way.

Some research suggests that the lowest WHRs (i.e., those often rated most attractive in well-nourished populations) are often associated with poorer health outcomes and lower fertility (Lassek & Gaulin, 2018). These findings provide strong challenge to the current fertility hypothesis and lend support to the nubility hypothesis.

Taken together, if men are selecting mostly for current fertility cues, then sex dolls should approximate the WHRs of women at peak fertility (typically in their mid-to-late 20s, ~0.7). If men are more attracted to cues of nubility, then sex dolls should exhibit cues of youth and nulliparity, reflecting WHRs much lower than those typically found in peak fertility aged women.

Prediction 1

If men's preferences reflect an attraction to nubility, sex dolls should exhibit exaggeratedly low WHRs, well below those typically found in naturally occurring female bodies.

Do Men Prefer a Low WHR or Simply a Narrow Waist?

There is another ongoing debate in the evolutionary literature regarding male mate preferences. R. Brooks et al. (2010) suggests that low WHRs may provide only a proxy for attractiveness rather than conveying special biological information beyond size, weight, and the amount of body fat. Some evidence in support of this perspective includes cross-cultural research using natural stimuli, which reveals that BMI accounts for 2–3 times more variance than WHR in women's attractiveness (Swami, Antonakopoulos et al., 2006; Swami, Caprario et al., 2006; Swami et al., 2007; Swami & Tovée, 2007). Using digital silhouettes, Kościński (2013, 2014) also found that BMI accounted for twice as much variance in women's bodily attractiveness as WHR.

If WHR itself were the main attractiveness cue, then men should be equally attracted to low WHRs achieved by either a small waist or larger hips. Real-world attractiveness shows that men strongly prefer small waists even when hip size does not increase proportionally (Rozmus-Wrzesinska & Pawlowski, 2005). In the relatively few studies that have considered the possible independent role of waist size, it has been a strong predictor of attractiveness (Brody & Weiss, 2013; R. Brooks et al., 2010; R. C. Brooks et al., 2015; Crossley et al., 2012; Forestell et al., 2004; Gründl et al., 2009; Horvath, 1979; Pokrywka et al., 2006; Prantl & Gründl, 2011; Rilling et al., 2009; Rozmus-Wrzesinska & Pawlowski, 2005).

Expanding on these findings, Lassek and Gaulin (2016) conducted a comprehensive analysis comparing real women, Playboy Playmates,

and imaginary women (e.g., cartoon and video game characters). They found that waist size, not WHR or hip size, was the strongest determinant of female attractiveness. Waist size alone explained the relationship between WHR and attractiveness, suggesting that WHR's predictive power is largely an artifact of waist circumference. Attractive women, including Playboy Playmates, consistently had much smaller waists than less attractive women, but their hip sizes were relatively similar. Imaginary women, unconstrained by anatomical limitations, had even smaller waists than Playboy Playmates.

Some more compelling evidence comes from R. C. Brooks et al. (2015), who conducted a digital evolution experiment to test which body traits evolved under selection for attractiveness. They created 3D models of female bodies that varied across 24 independent traits (e.g., waist size, hip size, leg length, and bust size). These models underwent eight generations of selection, where participants rated attractiveness, and the most attractive bodies were digitally bred to produce the next generation. They found that waist girth was the strongest predictor of attractiveness, and that it was far stronger than WHR, which did not provide additional predictive power beyond waist size alone. They also found that waists shrank across generations, but hips did not proportionally enlarge, meaning WHR decreased as a secondary effect rather than a primary selection target. Longer legs and larger busts became more attractive within already slender models, suggesting shape matters, but only within the context of small waists. This is some direct experimental evidence in favor of the hypothesis that waist size is the primary selection target rather than WHR per se.

Sex dolls provide a unique opportunity to contribute some evidence in support of the hypothesis put forward by R. C. Brooks et al. (2015) and Lassek and Gaulin (2016). If they are correct, and waist size rather than WHR per se is the key factor driving male attraction, sex dolls should exhibit less variability in their waist size than their hips. Waist size should also remain stable while hip size increases alongside bust size, much like it does in real women. Regardless of other body proportion variations, I hypothesize, as per R. C. Brooks et al. (2015) and Lassek and Gaulin (2016), that a small waist is a nonnegotiable feature in sex doll design. Although bust and hip sizes may vary, waist size is expected to remain consistently small, reinforcing the idea that men prioritize narrow waists over WHR itself.

Prediction 2

Sex dolls will have less variability in waist size than hip size.

Supernormal Stimuli in Sex Dolls: WHR, Breasts, Height, and Foot Size

An initial aim of this study is to assess whether the design of sex dolls offers a novel source of evidence for male mate preferences. This is an approach that is consistent with evolutionary psychology's emphasis on triangulating converging evidence from multiple domains for an effect (Costello et al., in press; Schmitt & Pilcher, 2004). Although one might ostensibly expect sex doll design to reflect men's underlying preferences, the precise form they will take is less clear.

Supernormal stimuli refers to exaggerated imitations of naturally evolved phenomena that exert a stronger attraction than the natural objects themselves (Tinbergen, 1951). Ethologists Niko Tinbergen and Konrad Lorenz observed that certain exaggerated traits could elicit stronger behavioral responses, as seen in examples like the cuckoo bird's egg, which appears similar to the host's eggs but is usually larger and brighter, thus more attractive to the host bird (Tinbergen & Perdeck, 1951). Experiments with the three-spined stickleback fish also showed that male sticklebacks ignored a real mate to fight a brighter red dummy (Tinbergen, 1951).

Some examples of supernormal stimuli in humans include high heeled shoes which exaggerate the lumbar curvature (Lewis et al., 2017; Morris et al., 2013); fast food intensifying flavor (Saad, 2011); and narcotic drugs which heighten the activation of neural pleasure circuits in the brain (Barrett, 2010). Sex is a clear arena for studying supernormal stimuli. This is evident in pornography (Salmon et al., 2020), comic books and film (Burch & Johnsen, 2020; Burch & Widman, 2023), cosmetic surgery, and fashion accessories such as cinched waists and padded bras (Davis & Arnocky, 2022).

WHR

The most relevant human analog of a supernormal stimulus here is men's sexual preference

for extremely low WHRs itself. Most studies of WHR and attractiveness do not offer values below 0.7, but those that do often find men prefer even lower WHRs, including 0.6, which is within the human female range but very rare (Dixson et al., 2007, 2010; Singh, 1994).

Perhaps in the human environment of evolutionary adaptedness (Tooby & Cosmides, 1990), there was typically no such thing as a woman with too low a WHR, and selection may have favored a simple psychological mechanism instantiating the rule "lower is better." The maximally attractive WHR thus may be supernormally low (Symons, 1995, p. 111).

Idealized female figures in media consistently feature exaggeratedly low WHRs. Playboy Playmates, for instance, have an average WHR of 0.68, which is 2 *SD*s below that of college-aged women (0.74; Lassek & Gaulin, 2016). In cartoons, and video games, the most attractive female characters average a WHR of 0.55, which is 5 *SD*s below that of undergraduate women (Lassek & Gaulin, 2016).

Comic book analyses reveal similar trends. Among 323 female Marvel characters, the mean WHR was 0.60 ± 0.07, with 34 characters exhibiting a WHR of 0.61, which is 2 *SD*s lower than the 0.72 WHR of the actresses portraying them in films (Burch & Johnsen, 2020). This pattern is also evident in detective comics (Burch & Widman, 2023). Meanwhile, Jessica Rabbit, widely recognized as one of the most attractive female cartoon characters, has a WHR of 0.42 (Lassek & Gaulin, 2016).

Finally, Marković (2017) provide empirical support for the preference-for-the-supernormal hypothesis over the preference-for-the-average hypothesis. In a study of 456 participants evaluating WHR using computer-generated stimuli, men consistently preferred WHRs smaller than the average, reinforcing the supernormal preference.

Prediction 3

Female sex dolls will exhibit exaggeratedly low WHRs compared to those typically observed in naturally occurring female bodies.

Breasts. Human female breasts are a unique secondary sexual characteristic because, unlike other primates, they permanently enlarge after puberty and remain enlarged prior to lactation and pregnancy. This distinct feature has led researchers to propose that breasts have been sexually selected as a cue to women's sexual maturity and residual reproductive value (F. Marlowe, 1998). Research indicates that women with larger breasts exhibit higher estradiol levels, suggesting that breast size may serve as an honest cue of reproductive potential (Jasieńska et al., 2004).

Eye-tracking studies highlight the perceptual salience of breasts in male sexual attraction. Men tend to fixate on the breast region more than any other part of the female body (Garza et al., 2016; Hewig et al., 2008), with greater visual attention directed toward larger breasts (Pazhoohi, Arantes, et al., 2020; Pazhoohi, Garza, & Kingstone, 2020; cf. Dixson et al., 2011). Electroencephalographic studies also suggest that larger breasts elicit stronger neural responses (Pazhoohi, Arantes, et al., 2020; Pazhoohi, Garza, & Kingstone, 2020).

Women with larger breasts are rated higher in attractiveness and in being a threat to other women (Fink et al., 2014). Breast augmentation is the most popular cosmetic surgery worldwide (Davis & Arnocky, 2022), and many women report increased self-esteem and sexual well-being following surgery (Klassen et al., 2009). Women also engage in subtle enhancement strategies, such as wearing push-up bras, particularly when primed with images of attractive female breasts (Garza & Pazhoohi, 2023a, 2023b). Women also perceive large-breasted women as a greater threat to their current partnerships and are less likely to introduce their partners to women with large breasts, suggesting that they recognize men's preferences and act strategically to mitigate potential mate-poaching threats (Garza & Pazhoohi, 2023a, 2023b).

The commercial sex industry also capitalizes on men's breast preferences, with larger-breasted women commanding higher prices (Prokop et al., 2020). Men have also been documented to desire larger breasts on women's bodies than the women would prefer themselves (Prantl & Gründl, 2011). Given that sex dolls are designed to appeal to male preferences, they provide a unique opportunity to assess the extent to which these preferences are exaggerated when unconstrained by biology.

Although significant individual and cultural variation exists (Dixson et al., 2011; Ford & Beach, 1951; Havlíček et al., 2017; Swami & Tovée, 2013a, 2013b), the weight of evidence

suggests that larger breasts tend to be rated as attractive, garner more visual attention, and hold competitive and commercial value. It is likely then that sex dolls feature exaggeratedly large breasts that exceed those commonly found in real women.

Furthermore, men who score higher in sexism (Pazhoohi, Arantes, et al., 2020; Pazhoohi, Garza, & Kingstone, 2020) and those with an unrestricted sociosexuality (who are more open to casual sexual encounters) tend to prefer larger breasts (Zelazniewicz & Pawlowski, 2011; cf. Havlíček et al., 2017). Research shows that sex doll owners are more likely to objectify women (Harper et al., 2023), and it is plausible that they have a more unrestricted sociosexuality. The design of sex dolls, therefore, likely reflects the specific preferences of their target consumers, who may favor hypersexualized, exaggeratedly large breast sizes.

Prediction 4

Female sex dolls will have disproportionately larger breasts than real women.

Height. Unlike other analyses in this study, which focus on male mate preferences, the analysis of height includes a test of female preferences. In ancestral environments, contest competition—where males directly competed with rivals for access to mates—favored traits such as greater body size, strength, and aggression in men (Puts, 2010). Female mate preferences have evolved in tandem, favoring height as a reliable cue of a male's ability to compete for resources, status, and protection. Taller stature in men is associated with other qualities women find attractive, such as dominance (Stulp et al., 2015), strength (Vaz et al., 2002), and socioeconomic status (Gawley et al., 2009; Judge & Cable, 2004; Tyrrell et al., 2016).

Women consistently prefer taller men as mates (Buss & Schmitt, 1993; Courtiol et al., 2010). Empirical evidence from personal ads suggests that height is highly valued in male partners: 80% of women who mentioned height preferred men at least 6-feet tall (Cameron et al., 1977), and taller men receive more responses than shorter men (Lynn & Shurgot, 1984; Pawlowski & Koziel, 2002). This preference extends to speed dating settings (Kurzban & Weeden, 2005), and in one study women ranked height as the fifth most desirable trait in an ideal mate (Montoya, 2007).

Height is positively correlated with reproductive success (Nettle, 2002; Pawlowski et al., 2000), though this effect is curvilinear (Stulp et al., 2012). Height itself is highly heritable (~80%; Macgregor et al., 2006; McEvoy & Visscher, 2009; Silventoinen et al., 2001), meaning that women who choose taller men as mates are highly likely to pass this propensity for taller height to offspring, which would reinforce the mate preference. Women's preference for male height is also strongest during peak fertility (Pawlowski & Jasienska, 2005), and very short men report fewer sexual partners (Frederick & Jenkins, 2015).

Although some men prefer shorter women, this preference is not as strong as women's preference for taller men (Stulp et al., 2013). Both sexes exhibit assortative mating, where taller individuals prefer taller partners and shorter individuals prefer shorter partners, yet both typically prefer relationships in which the man is taller (Fink et al., 2007; Pawlowski, 2003; Stulp et al., 2017). A classic study of 720 married couples found only one case where the wife was taller than the husband (Gillis & Avis, 1980). An analysis of 2,000 personal ads found that only 4% of women would accept a dating scenario in which the man was shorter, whereas about 23% of men were willing to date a taller woman (Salska et al., 2008). In a U.S. sample, 55% of women said they would only date men taller than themselves, whereas just 37% of men required a shorter female partner (Yancey & Emerson, 2016). Not only do women prefer men who are taller than themselves, but they tend to be most satisfied when their male partner is about 20 cm (8 inches) taller, whereas men prefer a more modest height gap of about 8 cm (approximately 3.15 inches; Stulp et al., 2013). Cross-cultural evidence mostly supports the robustness of this preference (Pisanski et al., 2022; cf. Sear & Marlowe, 2009; Sorokowski & Butovskaya, 2012).

Some research suggests that male sex dolls also exaggerate traits typically preferred by women. For instance, they are usually muscular, and their average erect penis length (18.7 cm) exceeds the U.S. male average of 13.1 cm (Hanson et al., 2024). If their design reflects female mate preferences, one would expect male sex dolls to also be disproportionately tall, exaggerating a trait women

consistently prefer, whereas female sex dolls might more closely resemble the average stature of real women. If supported, this would suggest that supernormal exaggeration in sex dolls primarily targets traits for which mate preferences are strong and directional, such as low WHR in women and height in men.

Prediction 5

Male sex dolls should be disproportionately taller than real men, exaggerating the trait in alignment with female preferences, whereas female sex dolls should closely match the height distribution of real women.

Foot Size. Although much attention has been given to male preferences for traits such as facial neoteny (Jones et al., 1995) and WHR (Singh, 1993a, 1993b), a less-studied but important feature is foot size. Empirical research suggests that human foot size is sexually dimorphic, with men having larger feet relative to stature than women (Fessler, Haley, & Lal, 2005; Fessler, Nettle, et al., 2005; Voracek et al., 2007). This sexual dimorphism is arguably the opposite of what one might expect from purely biomechanical selection pressures. From a functional, biomechanical perspective, one would expect pregnancy to select for proportionately larger female feet to enhance stability, as pregnancy increases anteriorly placed weight, raises the center of gravity, and requires greater plantar flexion control (Foti et al., 2000). Larger feet could theoretically reduce fall risk during pregnancy, which is one of the leading causes of fetal injury and miscarriage in hunter-gatherer societies (J. K. Williams et al., 1990). Although some degree of sexual dimorphism may be explained by greater body mass in men requiring larger feet for stability, this alone does not fully account for the observed patterns.

One plausible alternative explanation is sexual selection. As foot size increases with age and parity, smaller feet may be an honest indicator of youthfulness and a lack of previous pregnancies (Bird et al., 1999; Block et al., 1985; Chantelau & Gede, 2002). A cross-cultural study spanning nine societies found that men consistently preferred women with proportionally smaller feet, whereas men with average foot size were rated as the most attractive (Fessler, Haley, & Lal, 2005; Fessler, Nettle, et al., 2005).

These findings challenge the observational hypothesis, which suggests aesthetic preferences merely reflect existing sex differences in morphology. According to this view, larger feet should enhance male attractiveness, just as smaller feet enhance female attractiveness. However, Fessler, Haley, and Lal (2005) and Fessler, Nettle, et al. (2005) found that men with proportionately larger feet were not rated as more attractive; rather, men with average foot size were preferred. If the hypothesis were correct, women should favor large male feet as men favor small female feet, yet only the latter preference emerges, suggesting sexual selection acts on female foot size in a more pronounced way than it does on male feet.

Historical and cross-cultural evidence supports the idea that small feet are seen as attractive in women. Chinese foot binding, a practice spanning over a thousand years, artificially created extremely small feet in women, reflecting the cultural emphasis on a preexisting biological preference (Jackson, 1997). Even in modern contexts, many women frequently wear shoes that are too small for their feet, leading to chronic foot problems (Frey et al., 1993), a phenomenon not observed in men. Such cultural patterns reinforce the hypothesis that female foot size is an attractiveness cue in women.

If men's mate preferences reflect a bias for cues of nubility, sex dolls should exhibit exaggeratedly small feet relative to height, perhaps even smaller than the lower bound observed in real women. As male foot size does not appear to be as strong a target of sexual selection, male sex dolls should have feet that are closer in proportion to real human males' feet, with less deviation from the population average.

Prediction 6

Female sex dolls should exhibit disproportionately small feet relative to their height compared to real women. In contrast, male sex dolls' foot-to-stature ratios should differ less from real men's, as large foot size in men is not a strong female mate preference.

Method

Data

The data set originally collected and made publicly available by Hanson et al. (2024) consisted of 815 commercially available sex dolls collected

from various manufacturers. The data set is available at the following link: https://osf.io/ym9d2/files/osfstorage. After filtering for complete data on measures of interest, 793 female dolls remained for analysis.

To contextualize the body dimensions of sex dolls, I compared their WHRs to a sample of real women drawn from the publicly available National Health and Nutrition Examination Survey (NHANES) 2021–2023 data set. NHANES is a nationally representative study conducted by the National Center for Health Statistics (2023) that includes physiological and anthropometric measurements collected by trained medical personnel from a randomly selected U.S. sample of approximately 5,000 individuals annually.

To assess foot proportions, I compared sex dolls' foot-length-to-stature ratio to real human data from Fessler, Haley, and Lal (2005) and Fessler, Nettle, et al. (2005). As raw data from Fessler, Haley, and Lal (2005) and Fessler, Nettle, et al. (2005) were unavailable, this comparison was conducted against the published mean values for human foot-to-stature ratios. The results should be interpreted with this limitation in mind. Following Hanson et al. (2024), I used the reported means, standard deviations, and sample sizes from Wardle et al.'s (2006) study of U.S. university students ($N = 1{,}673$; 1,018 women, 655 men) to compare the height of sex dolls to real human height. Although Hanson et al. (2024) reported descriptive statistics for sex doll and human heights, they did not conduct statistical comparisons. In the present study, I formally tested these differences using independent-samples t tests based on summary statistics and effect size calculations (Cohen's d) to quantify the magnitude of disparities. Finally, to assess breast size, I compared the distribution of sex dolls' cup sizes to human breast size data from Forbes and Frederick (2008), which estimates natural breast size distribution among young adult U.S. women.

Data Cleaning and Variable Calculation

To create a biologically relevant comparison group, I restricted the NHANES data set to nonpregnant women aged 18–30 years, resulting in a final sample of 345 women. For the sex doll data set, I filtered out male and transgender dolls, retaining only those classified as female. Entries missing waist or hip circumference were removed, and outliers were excluded using the interquartile range method, eliminating waist sizes below 30 cm or above 80 cm, and hip sizes exceeding 140 cm. After cleaning, the final data set consisted of 723 sex dolls, ensuring it reflected the central tendencies of commercially available models. WHR was calculated for each sex doll as waist circumference divided by hip circumference.

Results

Figure 1 presents the WHR distributions for real women and sex dolls. The sex dolls' WHRs cluster around 0.62, while real women's WHRs are centered at 0.85, demonstrating a substantial difference. A Welch's t test confirmed this difference was highly significant, $t(624.24) = 47.73$, $p < .001$, with a very large effect size ($d = 3.23$, 95% confidence interval [CI] [3.04, 3.41]). The bootstrapped 95% CI for the mean WHR difference [0.22, 0.24] closely matched the t test CI, ensuring the robustness of results. These findings strongly support Prediction 1 that sex dolls reflect exaggerated nubility rather than current fertility, and Prediction 3 that WHR proportions enter into the realm of supernormal stimuli.

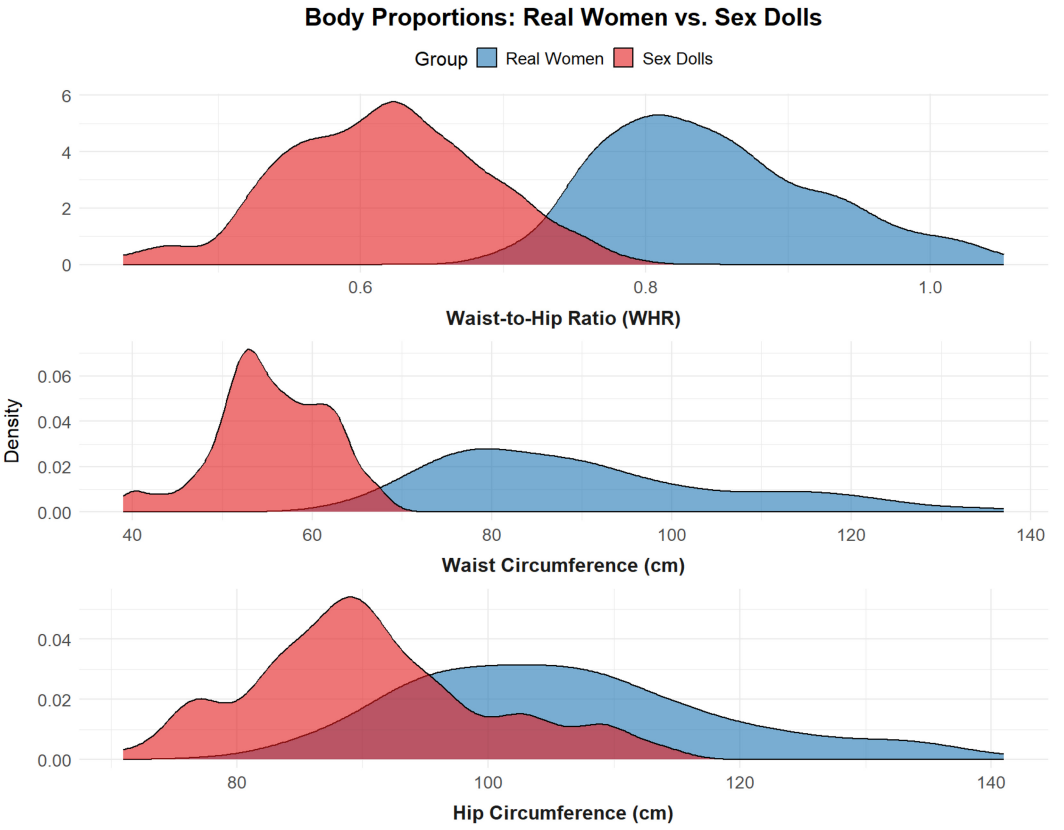
Figure 1 presents the density distributions of waist and hip circumferences for real women and sex dolls. The waist distribution shows a pronounced difference, with sex dolls exhibiting significantly smaller waists ($M \approx 55$ cm) compared to real women ($M \approx 85$ cm), with minimal overlap. The hip distribution, in contrast, reveals a more moderate difference, with sex dolls' hips ($M \approx 85$–95 cm) being somewhat smaller than real women's hips ($M \approx 100$–110 cm), but with greater overlap between groups.

Sex dolls exhibited 52% more variability in hip size ($SD = 9.36$ cm) than waist size ($SD = 6.15$ cm), indicating that manufacturers allow greater flexibility in hip proportions while tightly constraining waist size. The standardized difference was more than twice as large for waist size ($d = 3.30$, 95% CI [3.11, 3.49]) than for hip size ($d = 1.49$, 95% CI [1.35, 1.64]). A statistical comparison confirmed that this difference was significant (Steiger's $Z = 23.68$, $p < .001$), supporting Prediction 2 that a small waist is a key design feature in sex dolls rather than an emphasis on WHR alone.

In the sex dolls, breast cup size was weakly correlated with waist size ($r = .02$) but showed a moderate positive correlation with hip size

Figure 1

Density Plots Comparing the WHR, Waist Circumference (Centimeters), and Hip Circumference (Centimeters) Distributions Between Real Women and Commercially Available Female Sex Dolls



Note. Sex dolls consistently display significantly lower WHRs and waist circumferences, with relatively more moderate differences in hip circumference compared to real women. WHR = waist-to-hip ratio. See the online article for the color version of this figure.

($r = .39$). These correlations differed significantly with a moderate-to-large effect size ($Z = 5.67$, $p < .001$, $q = -.39$). Figure 2 presents scatterplots illustrating these relationships. Results remained consistent when using imputed data, confirming that missing data did not affect the observed pattern. These findings further support Prediction 2 that a small waist is a nonnegotiable feature of sex doll design.

Breast Size Comparisons

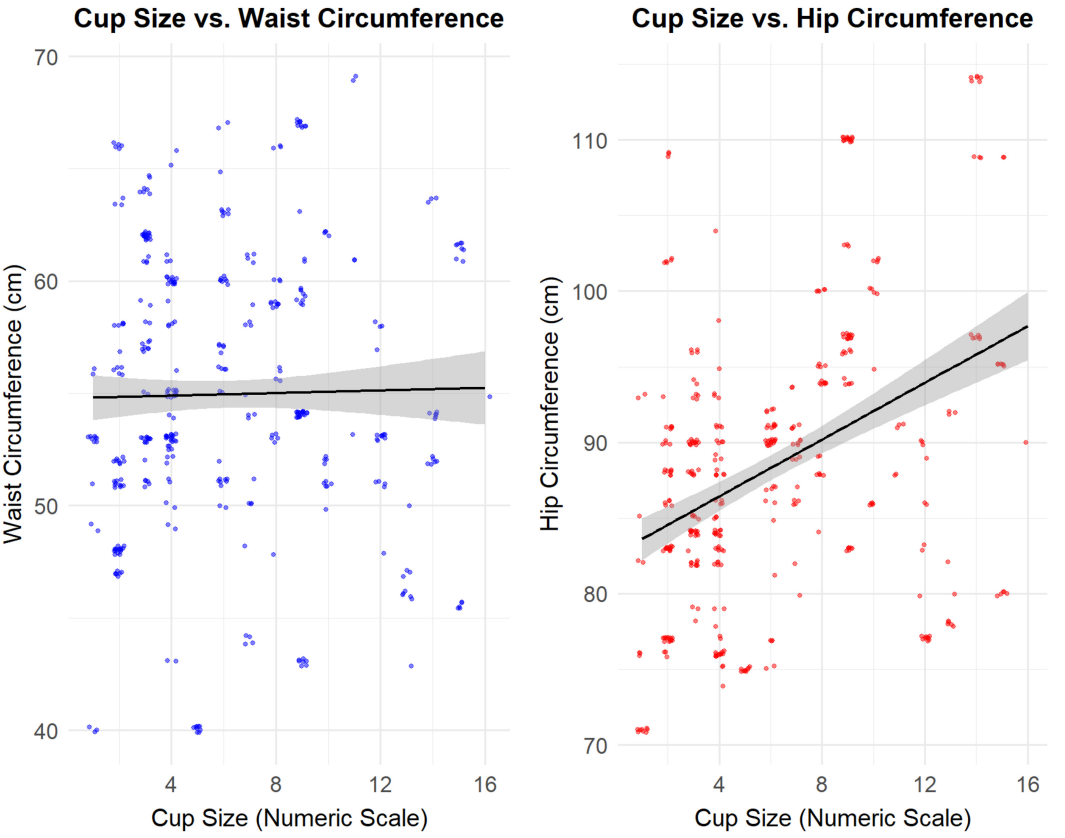
In support of Prediction 4, female sex dolls' breast sizes were generally much larger than humans', but with considerable variation (see Table 1). An analysis of the 414 dolls that had cup size listed showed that about half (48.6%) of sex dolls had cup sizes E–O, sizes large and infrequent enough that they are not included in many studies on young women's breast sizes (Forbes & Frederick, 2008).

Height

Contrary to Prediction 5, female sex dolls were significantly shorter than real college aged women, $t(1,771) = -10.35$, $p < .001$, with a medium effect size ($d = -0.50$), and male sex dolls were also significantly shorter than real men, $t(686) = -9.28$, $p < .001$, with a much larger effect size ($d = -1.57$). The difference in effect sizes ($d = 1.07$) indicates that

Figure 2

Scatterplots Illustrate the Weak Correlation Between Cup Size and Waist Circumference (Left) and the Moderate Positive Correlation Between Cup Size and Hip Circumference (Right) in the Complete Data Set



Note. Shaded areas represent 95% confidence intervals. See the online article for the color version of this figure.

the deviation of male sex dolls from real men was more pronounced than the deviation of female sex dolls from real women.

Foot-Length-to-Stature Ratio Comparison

To assess whether sex dolls exhibit exaggeratedly small feet compared to real humans, I calculated the foot-length-to-stature ratio and compared it to published data from Fessler, Haley, and Lal (2005) and Fessler, Nettle, et al. (2005). Figure 3 illustrates the density distribution of foot-to-stature ratios in male and female sex dolls alongside human population norms. Female sex dolls had a significantly smaller foot-to-stature ratio ($M = 13.07\%$, $SD = 0.86$) than human women ($M \approx 14.67\%$–14.80%), $t(520) = -56.28$, $p < .001$, 95% CI [lower bound, 13.12%], with a large effect size ($d = -1.96$). This finding supports Prediction 6 that small feet serve as an exaggerated cue of nubility.

Further supporting Prediction 6, male sex dolls ($n = 29$) also had significantly smaller foot-to-stature ratios than human men ($M = 14.57\%$, $SD = 0.79$ vs. 15.2%), $t(28) = -4.29$, $p < .001$, 95% CI [14.27, 14.87], though the effect was moderate to large ($d = -0.79$). Although female sex dolls strongly exaggerate small feet, male sex dolls' proportions more closely resemble human norms, though they remain slightly smaller. This pattern aligns with prior research suggesting strong male preferences for small female feet but no strong preference for exaggerated foot size in men (Fessler, Haley, & Lal, 2005; Fessler, Nettle, et al., 2005).

Table 1
Breast Size in Sex Dolls and Humans

Breast cup sizes	Female-sexed dolls	Female humans	Difference (%)	Statistical test
A	16 (3.9%)	153 (26.2%)	−22.3	$p < .001$, $V = -.29$
B	56 (13.5%)	224 (38.4%)	−24.9	$p < .001$, $V = -.27$
C	62 (15.0%)	147 (25.2%)	−10.2	$p < .001$, $V = -.12$
D	79 (19.1%)	59 (10.1%)	+9.0	$p < .001$, $V = +.13$
E–O	201 (48.6%)	0 (0.0%)	+48.6	$p < .001$, $V = +.60$

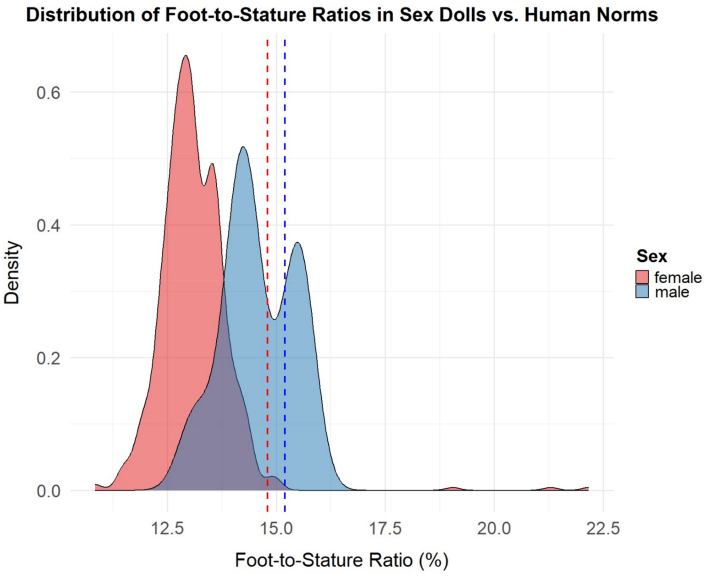
Note. Absolute and relative frequencies. Human female cup size distribution based on Forbes and Frederick (2008). $N = 583$. Statistical tests: two-dimensional χ^2 tests. Effect sizes: V = Cramér's V. These statistics were originally reported in Hanson et al. (2024).

Discussion

Sex dolls provide a window into men's unconstrained mate preferences, as they are designed solely to appeal to consumer demand. Using data from Hanson et al. (2024), this study found that sex dolls exhibit significantly lower WHRs than real, fertile-aged women, with minimal overlap in distribution. These data support the hypotheses that male preferences prioritize cues of nubility over current fertility, and when unconstrained, extend beyond naturally occurring proportions into the realm of supernormal stimuli.

Correlational analyses showed that waist size remained relatively stable across bust sizes, while hip size increased more proportionately. The correlation between bust size and hip size was significantly stronger than the correlation

Figure 3
Density Plot Showing the Distribution of Foot-to-Stature Ratios in Male and Female Sex Dolls Compared to Human Population Norms



Note. The red (dark gray) dashed line represents the upper bound of human female foot-to-stature ratios (14.80%) as reported by Fessler, Haley, and Lal (2005) and Fessler, Nettle, et al. (2005), while the blue (light gray) dashed line represents the human male average (15.2%). See the online article for the color version of this figure.

between bust size and waist size, suggesting that waist narrowness is prioritized over WHR itself in sex doll design. These findings lend support to the hypothesis put forward by R. C. Brooks et al. (2015) and Lassek and Gaulin (2016) that men's mate preferences may primarily track waist size rather than WHR per se.

Waist narrowness appears to be a more stable aspect of men's mate preferences, whereas other traits may be more flexible. An analogue can be made between this pattern and the mate preference priority model (Li et al., 2002), which distinguishes between necessities and luxuries in mate selection. When individuals have limited resources (e.g., in a low-budget condition), they allocate those resources toward traits that are essential in their mate preference criteria (e.g., men prioritize physical attractiveness, women prioritize status). Only when additional resources become available do they start selecting for luxuries, such as humor (Li, 2007). Applying this framework to sex doll design, a narrow waist appears to function as a necessity rather than a luxury in artificial female bodies, consistently present across all variations. In contrast, bust and hip size exhibit far greater variation, suggesting that they are not as essential to male attraction like a small waist is.

One reason waist narrowness may hold this priority in mate selection is that, in most ancestral environments, a less slim waist likely suggested pregnancy or a history of pregnancies in a more salient way than other traits. Although modern environments have altered the relationship between waist size and reproductive status because of factors such as diet, ancestral conditions would likely have reinforced the perception that a narrow waist is a cue of nulliparity. At the same time, a very slim waist without sufficient corresponding hip width may indicate extreme thinness or even reproductive dysfunction (Frisch, 1985).

Female sex dolls were designed with disproportionately large breasts, as predicted. However, it should be noted that significant individual and cross-cultural variation is often observed for men's preferences for breast size, in real women (Dixson et al., 2015; Gray & Frederick, 2012; Havlíček et al., 2017; Pazhoohi, Arantes, et al., 2020; Pazhoohi, Garza, & Kingstone, 2020; Zelazniewicz & Pawlowski, 2011) and in the design of sex dolls. What may be more important than size per se is ptosis (firmness vs. sagging). Firm breasts are associated with youth and nulliparity, as breast ptosis (sagging) increases with age and parity (Rinker et al., 2008). Men typically consider women with firmer breasts physically attractive and often prioritize firmness over size (Doyle & Pazhoohi, 2012; Groyecka et al., 2017; Kościński, 2019). This aligns with the nubility hypothesis, which posits that male mate preferences target cues of long-term reproductive potential rather than immediate fertility alone (F. Marlowe, 1998). Although not available in this data set, future research should investigate what other features of women's breast morphology, such as areola pigmentation (a cue to reproductive status; see Garza & Pazhoohi, 2023a, 2023b for a review), nipple erection (Burch & Widman, 2021, 2024), and breast cleavage (i.e., intermammary distance; Garza et al., 2021), may be represented in sex doll design.

In line with predictions, female sex dolls also had disproportionately small feet relative to stature than real women. Male sex dolls' foot proportions were only slightly smaller than real men's, supporting Fessler, Haley, and Lal's (2005) and Fessler, Nettle, et al.'s (2005) hypothesis that small feet serve as a cue of nubility in women.

An Error Management Bias Toward Supernormal Stimuli

The supernormally exaggerated proportions observed in sex dolls may also be interpreted through the lens of error management theory (Buss, personal communication, March 2025; Haselton & Buss, 2000). Error management theory posits that when faced with uncertainty, selection should favor biases that minimize the more costly error. In the context of mate preferences, it may have been more adaptive for men to err on the side of selecting mates with exaggerated cues of reproductive potential than to risk selecting a reproductively nonviable mate. Small breasts, for example, may have been a cue of prepubescence or low estrogen levels, leading to the risk of selecting a mate who was not yet reproductively mature (F. Marlowe, 1998). A larger waist could have been a cue to pregnancy, an endocrinological affliction, or older age, all of which are correlated with lower reproductive value (Singh, 1993a, 1993b).

Selection may have favored a preference for larger breasts (as a cue of reproductive maturity) and a narrower waist (as a cue of nulliparity and youth), even at the less costly error of preferring

traits at the edges or outside of the naturally occurring range. Supernormal stimuli, as occurs with sex dolls and some forms of Japanese anime (Barrett, 2010), may exploit these error management biases, as the reproductive costs of selecting an infertile mate would have outweighed the minimal costs of occasionally preferring exaggerated features (Buss, personal communication, March 2025). These novel speculative hypotheses remain to be tested.

The Coevolution of the Market and Our Preferences

One might argue that sex doll specifications simply reflect market offerings rather than revealing men's underlying preferences. However, market forces and human desires coevolve to shape each other. A classic example is the evolution of the teddy bear. Originally modeled after a real bear, teddy bears have evolved over time to display more juvenile features, such as larger foreheads and shorter snouts, driven by human preferences for traits that elicit nurturing and protective feelings (Hinde & Barden, 1985). The cartoon character Mickey Mouse has also become rounder and more childlike over time to appeal to human emotions (Gould, 2008). These preferences are deeply rooted in our biology, as they activate emotional bonding mechanisms (Lorenz, 1950).

Ultimately, businesses that create and sell sex dolls are driven by profit and will naturally design their products to align with what men are most likely to purchase. A company producing dolls with a WHR of 1.2 would likely struggle to find a market. Manufacturers tailor their designs to match the traits that men consistently gravitate toward, ensuring their products are both desirable and commercially successful.

Implications of Artificial Intimacy for Human Mating

One concern is that sex dolls could promote unrealistic and hypersexualized beauty standards (Ray, 2016; Valverde, 2012). As supernormal stimuli, sex dolls with exaggerated body proportions might set unrealistic expectations for men, potentially leading to dissatisfaction in their interactions with real women. Some research shows that sex doll owners were more likely to see women as sex objects than non sex doll owners (Harper et al., 2023).

R. Brooks (2021) highlights another potential issue: the displacement of real-life relationships by artificial ones. When artificial forms of intimacy, such as sex dolls, become more sophisticated, they may take the place of human relationships. This shift could undermine the development of genuine connections and emotional bonds between individuals. Supernormal stimuli hijack evolved instincts across species, as seen in male jewel-beetles attempting to mate with beer bottles (Ryan, 2018). Could the artificial intimacy of sex dolls similarly misdirect human mating?

Despite reflecting unconstrained male preferences, sex dolls remain a crude facsimile of the female form, with significant technological limitations. This may explain why they are not adopted more broadly by men. According to a German national online sample of adults aged 18–69 years ($N = 2{,}000$), just 9% of men surveyed have used a sex doll (Döring & Pöschl, 2018). Although they may embody attractive traits, they do not yet provide interactive or emotionally engaging experiences comparable to real relationships (cf. Lievesley et al., 2023).

Another important consideration which can speak to why sex dolls are not used by more men is the current stigma associated with purchasing sex dolls, which is perceived as a low-status and "creepy" behavior (Knox et al., 2017). Sex and status are intricately intertwined (Buss et al., 2020), for instance, a man's self-perceived mate value often serves as a direct indicator of his self-esteem (Brase & Dillon, 2022), and romantic partners also serve as markers of social status (Winegard et al., 2013, 2017). Although sex dolls may address some immediate sexual needs, they do not confer the same social status or esteem that being sexually selected does.

The potential effects of sex dolls on male mating strategies might be significantly enhanced if they are integrated with more sophisticated artificial intelligence (AI) technology (Dubé & Anctil, 2021). As AI technology advances, allowing for more sophisticated interactions, the barriers to widespread adoption may decrease. Future AI-enhanced sex dolls could simulate meaningful companionship, making artificial intimacy more appealing and leading to a greater retreat from real-world mating into artificial alternatives

(R. Brooks, 2021). For those who are involuntarily single and report extremely poor mental health (Apostolou et al., 2023, 2024; Costello et al., 2022, 2024, 2025), AI-enhanced sex dolls could offer a fulfilling alternative to real human relationships, potentially improving their mental well-being.

Limitations and Future Directions

A key limitation of this study is the lack of direct attractiveness ratings or consumer preference data. The data set captures what features exist in sex dolls, but it does not reveal which dolls are actually preferred by men. Sales data could serve as a further proxy for attractiveness by indicating which doll configurations are most popular.

It is possible that some of the dolls in the data set have highly exaggerated proportions that appeal only to niche consumers, while others with more naturalistic proportions may sell in much higher volumes. Asking men to rate the appeal of different sex dolls would allow for a more precise test of the extent to which these exaggerated traits align with men's actual preferences.

Notably, both male and female sex dolls were significantly shorter than their human counterparts, the study's only deviation from predicted patterns. One plausible explanation for these anomalous findings is that practical constraints—such as manufacturing costs, weight distribution, and shipping logistics—may have influenced sex doll design more than mate preferences in this domain. The relatively small sample size of male dolls ($n = 33$) may also limit the generalizability of this finding, and a larger data set might reveal different patterns. Future research could clarify whether sex doll height reflects genuine consumer preferences or whether design constraints impose a uniform limitation across both male and female dolls.

Finally, a key area for future research is whether prolonged exposure to exaggerated, supernormal representations of the female form in sex dolls could distort men's real-world sexual preferences and relationship satisfaction. Longitudinal studies tracking changes in partner evaluations and sexual preferences among sex doll users over time would provide valuable insights into whether artificial intimacy influences mate selection criteria or relationship expectations.

Conclusion

This study provides a novel source of evidence that sex dolls reflect men's mate preferences, particularly for a low WHR, small feet as cues of nubility, and large breasts. These findings align with the concept of supernormal stimuli, adding another source to the evidence suggesting that men's mate preferences, when unconstrained by natural limitations, often extend beyond naturally occurring female body proportions.

The results of this study also support the hypothesis that waist narrowness, rather than WHR per se, is the more salient selection criterion. A small waist size appears to be a nonnegotiable feature of sex doll design, and relative to hip size did not scale up in proportion to increases in bust size. These findings are in concert with previous research showing that waist size, independent of WHR, is a critical predictor of female attractiveness.

Although sex dolls serve as an exaggerated reflection of men's preferences, their current adoption is constrained by factors such as status concerns and technological limitations. As AI integration advances, making sex dolls more interactive and emotionally engaging, their appeal may grow, potentially reshaping modern intimacy.

Future research should investigate the precise features men find most attractive in sex dolls and further explore the social and psychological consequences of artificial intimacy. As technology continues to evolve, understanding its impact on human relationships will be critical in anticipating both the benefits and challenges of a future increasingly shaped by artificial intimacy.

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