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Original Article

Cue-based estimates of reproductive value explain women's body attractiveness

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ABSTRACT

Women's body attractiveness is influenced by specific anthropometric cues, including body mass index (BMI), waist-to-hip ratio (WHR), waist-to-stature ratio (WSR), and shoulder-to-waist ratio (SWR). Despite the existence of multiple functional hypotheses to explain these preferences, it remains unclear which cue-based inferences are most influential in regulating evaluations of women's body attractiveness. We argue that (i) the common link to the morphological cues that influence women's body attractiveness is that they all reliably indicate high reproductive value (as defined by youth and low parity); and (ii) ancestrally, selection pressures related to tracking between-women differences in reproductive value would have been among the strongest acting on adaptations for body evaluation. An empirical study then tested the resulting prediction that cue-based estimates of reproductive value function as powerful regulators of women's body attractiveness judgments. Subjects viewed standardized photos of women in swimsuits (with heads obscured), and were assigned to either estimate components of their reproductive value (age or number of offspring) or rate their attractiveness. Structural equation modeling revealed that a latent variable capturing estimated reproductive value was almost perfectly correlated with a latent variable capturing body attractiveness. Moreover, unique associations of women's BMI, WHR, and WSR with their body attractiveness were entirely mediated via estimated reproductive value. These findings provide strong support for the longstanding hypothesis that women's body attractiveness is primarily explained by cue-based estimates of reproductive value – expected future utility as a vehicle of offspring production.

1. Introduction

Adaptationist approaches to explaining human physical attractiveness posit the existence of specialized evaluative mechanisms designed to produce attraction to cues that ancestrally predicted fitness-related properties of potential partners (Buss, 2012; Gangestad & Scheyd, 2005; Sugiyama, 2005, 2016). Some of the most robust and well-known findings in this literature pertain to the anthropometric features that influence the attractiveness of women's (non-facial) bodies, which include low waist-to-hip ratio (WHR; Singh, 1993, Singh & Young, 1995; Furnham, Moutafi, & Baguma, 2002; Furnham, Mistry, & McClelland, 2004; Furnham, Petrides, & Constantinides, 2005), low waist-to-stature ratio (WSR; Lassek & Gaulin, 2016), low body mass index (BMI; Singh & Young, 1995; Tovee, Maisey, Emery, & Cornelissen, 1999; Wang, Djafarian, Egedigwe, et al., 2015), and high shoulder-to-waist ratio (SWR; Grillot, Simmons, Lukaszewski, & Roney, 2014). Although the exact preferred values of these cues vary across societies in relation to local ranges of variation (Sugiyama, 2004; Tovee, Swami, Furnham, & Mangalparsad, 2006) and socioecological conditions such as resource scarcity (Hill, DelPriore, Rodeheffer, & Butterfield, 2014; Marlowe & Westman, 2001), their relevance within populations is cross-culturally consistent (Furnham et al., 2002; Marlowe, Apicella, & Reed, 2005; Mo et al., 2013; Sugiyama, 2005, 2016).

Theorists have hypothesized that bodily cues such as thinness and small relative waist size are interpreted by partner choice mechanisms as indicators of fecundity (Grillot et al., 2014; Confer, Perilloux, & Buss, 2010), fertility (Furnham et al., 2004), youthfulness (Furnham et al., 2004; Singh, 1993; Singh & Young, 1995; Wang et al., 2015), maternal investment behavior (Furnham et al., 2004), energy balance (Gangestad & Scheyd, 2005), or possession of specialized gluteofemoral fat stores important for offspring neurodevelopment (Lassek & Gaulin, 2008). Although there is evidence consistent with most of these non-mutually exclusive hypotheses, there is currently no consensus regarding which cue-based inferences – and therefore, which functional imperatives – are most influential in regulating body attractiveness judgments.

A common feature of the cues tied to women's body attractiveness is that they all covary with female reproductive value, i.e. the maximum

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number of offspring a woman is actuarially expected to produce moving forward from a given point in time (Fisher, 1930; cf. Buss, 2012; Symons, 1979). Among humans, reproductive value is primarily determined by age and parity, such that post-pubertal women who are young and nulliparous have greater reproductive value than older women with higher parity (Buss & Schmitt, 1993; Kenrick & Keefe, 1992; Symons, 1979). Waist size increases with both age and parity as a function of changes in abdominal fat deposition, which directly increases WHR and WSR (Lassek & Gaulin, 2006). WHR is further increased by parity-related depletion of specialized gluteofemoral deposits that are employed to build neural tissue in offspring (Lassek & Gaulin, 2006). These specific modulations of fat distribution occur in coordination with other developmental changes in metabolism (e.g., decreased resting metabolic rate; Hunter, Weinsier, Gower, & Wetzstein, 2001) that tend to produce positive associations of women's age and parity with overall fatness and body size, at least in well-nourished sedentary populations (Deurenberg, Westrate, & Seidell, 1991; Gallagher et al., 1996; Kim, Stein, & Martorell, 2007; Lassek & Gaulin, 2006). In sum, small relative waist size and low BMI are both reliable indicators of women's reproductive value as defined by youth and low parity.

The importance of reproductive value as a determinant of women's social attractiveness must be understood within the context of humans' unique life history and socioecology. Since humans last shared a common ancestor with Chimpanzees, our lineage acquired a suite of coevolved life history features – the "human adaptive complex" – that is defined by an extended lifespan, prolonged offspring dependency, a skill intensive foraging niche, and massive intergenerational transfers from parents (and grandparents) to offspring (Kaplan, Hill, Lancaster, & Hurtado, 2000). The functional imperatives created by these life historical changes, in turn, selected for a corresponding shift from promiscuous mating to mating systems that tend to include long-term pair bonds as a prominent feature (Chapais, 2008; Kaplan et al., 2000). Within (relatively) monogamous pair bonds, fathers have high paternity certainty, which incentivizes paternal investment in shared offspring – a long-term project whose efficiency is enhanced greatly by cooperation between parents and the sexual division of labor (Gurven, Winking, Kaplan, von Rueden, & McAllister, 2009; Kaplan et al., 2000). Against this backdrop, women's reproductive value becomes a crucial criterion of overall mate value. This is because a man's commitment to a particular woman and their shared offspring can potentially be rewarded by a monopoly on her entire reproductive career, the maximum output of which then serves as a limiting factor on the couple's in-pair fertility (Buss, 2012; Buss & Schmitt, 1993; Sugiyama, 2005; Symons, 1979). Moreover, all else being equal, younger women are expected to continue living for longer than older women, so a woman's youth also predicts the length of the time period during which she can invest behaviorally in the couple's children and grandchildren.

Over human history, people would have reliably co-existed with post-pubertal women ranging from adolescent nulligravidas (whose entire reproductive careers can be monopolized within long-term relationships) to menopausal grandmothers (whose reproductive value is zero). Tracking between-women differences in reproductive value would therefore have been strategically imperative for potential mates, intrasexual rivals, kin, and various other social actors whose interests depend on knowledge about the local dynamics of relationships, competition, or resource flows (Buss & Schmitt, 1993; Kenrick & Keefe, 1992; Sugiyama, 2005). Holding reproductive value constant, women surely also varied in their current fecundity and behavioral proclivities of maternal investment. However, ovarian hormone concentrations and fecundity have only a subtle relationship with visual cues in the body (e.g., Grillot et al., 2014), and there is no reason to believe that maternal behavioral variation has been robustly associated with body shape or fatness over human history. Moreover, a recent paper combining a systematic review of the literature and new empirical findings has convincingly falsified the hypothesis that the low BMIs and small waists found most attractive in women's bodies indicate good general health, reproductive health, and fertility (Lassek & Gaulin, 2017) – which renders unlikely some of the most frequently referenced functional explanations for the evolution of preferences for low BMI and small waist size. Thus, it seems likely that attractiveness-linked bodily features have been, and continue to be, more reliable cues to women's reproductive value than to other relevant characteristics.

These lines of reasoning suggest that selection pressures pertaining to estimation of women's reproductive value were likely among the strongest acting on human ancestors' mechanisms for body evaluation (Lassek & Gaulin, 2017; Sugiyama, 2005; Symons, 1979). If so, it follows that cue-based estimates of women's reproductive value may be the primary regulators of body attractiveness judgments. Consistent with this, in well-nourished sedentary populations, (i) BMI and related measures (e.g., body fat percentage, waist size) are consistent positive correlates of age and parity in women of reproductive age (Deurenberg et al., 1991; Gallagher et al., 1996; Kim et al., 2007; Lassek & Gaulin, 2006), and (ii) these measures of fatness correspondingly explain the majority of variance in body attractiveness judgments, with WHR and SWR explaining additional unique variance (Bleske-Rechek, Colb, Stern, Quigley, & Nelson, 2014; Grillot et al., 2014; Mo et al., 2013; Smith, Cornelissen, & Tovee, 2007; Wang et al., 2015). Converging evidence indicates that women with low BMI and WHR, respectively, are perceived as being younger (Furnham et al., 2002, 2004, 2005; Wang et al., 2015). However, despite the vastness of this literature, no study of which we are aware has specifically tested the hypothesis that the associations of women's bodily features with attractiveness judgments are mediated by cue-based estimates of reproductive value (as defined by youth and low parity).

1.1. The current study

The current study tested this hypothesis using standardized photographs of women wearing swimsuits who had been measured for BMI, WSR, WHR, and SWR. We asked different groups of raters to view the women's bodies sequentially and either (i) guess their age, (ii) guess their parity (number of offspring), or (iii) rate aspects of their body attractiveness. Because all the women in the photos were in actuality nulliparous young adults, the design we employ effectively holds constant unmeasured cues to actual age and parity. It therefore affords a clean test of the prediction that specific morphological cues are attractive primarily because they register as indicating high reproductive value as defined by youth and low parity.

This design also permitted us to address the question of which bodily dimensions explain the most unique variance in women's attractiveness. As described above, it has often been found that BMI explains much more unique variance in women's attractiveness than WHR or SWR (Bleske-Rechek et al., 2014; Grillot et al., 2014; Wang et al., 2015). However, Lassek and Gaulin (2016) recently reported multiple demonstrations of the novel finding that WSR explains more unique variance in attractiveness than either BMI or WHR. This suggests that small waist size drives the associations of BMI, WHR, and SWR with women's body attractiveness judgments. Thus, an auxiliary goal of the present study was to replicate and extend this finding by testing the comparative power of BMI, WSR, WHR, and SWR in predicting both estimated reproductive value and rated body attractiveness.

2. Materials and procedures

2.1. Female target stimuli

Targets in the photos were 72 young women (mean age = 20.7, range 19–23), all undergraduate students at a residential university in the Midwestern USA. Although the women were not asked about whether they had children, it would be highly unusual in this traditional college population for them to have been mothers at the time of