



Original Article

Women's faces and voices are cues to reproductive potential in industrial and forager societies[☆]



John R. Wheatley^a, Coren A. Apicella^b, Robert P. Burriss^c, Rodrigo A. Cárdenas^d, Drew H. Bailey^e,
Lisa L.M. Welling^{a,1}, David A. Puts^{a,f,*}

^a Department of Anthropology, Pennsylvania State University, University Park, PA 16802, USA

^b Department of Psychology, University of Pennsylvania, Philadelphia, PA 19104, USA

^c Department of Psychology, Northumbria University, Newcastle upon Tyne, UK

^d Department of Psychology, Pennsylvania State University, University Park, PA 16802, USA

^e Department of Psychology, Carnegie Mellon University, Pittsburgh, PA 15213, USA

^f Center for Brain, Behavior, and Cognition, Pennsylvania State University, University Park, PA 16802, USA

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ABSTRACT

Women's faces and voices may be cues to their reproductive potential. If so, then individual differences in indices of female fecundity and residual reproductive value, such as hormonal profiles, body composition, and age, should be associated with women's facial and vocal attractiveness to men. However, previous research on these associations is sparse, has rendered mixed results, and is limited to Western samples. The current study therefore explored relationships between correlates of reproductive capability (testosterone levels, age, and body mass index [BMI]) and facial and vocal attractiveness in women from industrial and foraging societies. Women's facial and vocal attractiveness was associated with each of these indicators in at least one of the two samples. The patterns of these associations suggest that women's faces and voices provide cues to both common and unique components of reproductive potential and help explain the evolution of men's mating preferences.

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1. Introduction

Many of the physical characteristics that we find attractive in others may reflect aspects of underlying mate quality, such as fecundity (Buss, 1989; Symons, 1979; Thornhill & Grammer, 1999). There is generally high agreement among men in their ratings of women's vocal and facial attractiveness, and women's facial attractiveness and vocal attractiveness correlate, suggesting that these features indicate mate quality (Collins & Missing, 2003; Feinberg, 2008; Feinberg, DeBruine, Jones, & Perrett, 2008; Hume & Montgomerie, 2001; Jones, Feinberg, DeBruine, Little, & Vukovic, 2008; Little, Jones, & DeBruine, 2011). Moreover, some studies suggest positive associations of fertility and fecundity with female attractiveness in both the face (Bobst & Lobmaier, 2012; Grammer,

Fink, Møller, & Thornhill, 2003; Johnston & Franklin, 1993; Law Smith et al., 2006; Pflüger, Oberzaucher, Katina, Holzleitner, & Grammer, 2012; Puts et al., 2013; Roberts et al., 2004) and voice (Bryant & Haselton, 2009; Pipitone & Gallup, 2008; Puts et al., 2013). Much of this evidence concerns within-individual variation in fecundity and attractiveness. For example, women's faces and voices are more attractive during the phase of the menstrual cycle when their progesterone levels are relatively low, and their voices are more attractive when estradiol is high relative to their progesterone levels (Puts et al., 2013). These hormonal states correspond with peak fecundability (probability of conception) within the ovulatory cycle (Baird et al., 1999; Landgren, Undén, & Diczfalusy, 1980). If women's faces and voices also provide information useful for discriminating between mates based on reproductive potential, then facial and vocal attractiveness should predict individual differences in indicators of fecundity, such as trait-level hormonal profiles (Apter & Vihko, 1990; Baird et al., 1999; Carmina & Lobo, 1999; Landgren et al., 1980; Lawrence, McGarrigle, Radwanska, & Swyer, 1976; Puts et al., 2013; van Anders & Watson, 2006), age (Andersen, Wohlfahrt, Christens, Olsen, & Melbye, 2000; Menken, Trussell, & Larsen, 1986), and body composition (Ellison, 2003; Frisch, 1987; Grodstein, Goldman, & Cramer, 1994; Hill & Hurtado, 1996; Veleza et al., 2008).

Women's reproductive capacity has been negatively linked to their testosterone (T) levels. In a 13-year longitudinal study of nonclinical

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* Corresponding author.

E-mail address: dap27@psu.edu (D.A. Puts).

¹ Current Address: Department of Psychology, Oakland University, Rochester, MI 48309.

females originally aged 7–17 years, age-adjusted serum T concentrations before any pregnancies were higher in women who subsequently had no pregnancies than in those who became pregnant (Apter & Vihko, 1990). High T concentrations are also associated with polycystic ovarian syndrome (PCOS) and anovulatory cycles (Carmina & Lobo, 1999). Among infertile women, ovulation induction resulted in a pregnancy rate of 75% in women with simple amenorrhea, but only 21% in women with PCOS and elevated androgens (Lawrence et al., 1976). The association between women's T concentrations and infertility appears to be due at least in part to menstrual cycle irregularity, which is negatively related to the likelihood of achieving pregnancy (Small et al., 2010). Higher T levels predicted menstrual cycle irregularity in large, nonclinical samples of both normally cycling and hormonally contracepting premenopausal women (van Anders & Watson, 2006; Wei, Schmidt, Dwyer, Norman, & Venn, 2009), as well as in adolescent girls (Fernandes et al., 2005).

Masculine facial and vocal characteristics are associated with high T in men (Dabbs & Mallinger, 1999; Evans, Neave, Wakelin, & Hamilton, 2008; Penton-Voak & Chen, 2004; Puts, Apicella, & Cárdenas, 2012). If the same is true of women, then we should see a negative relationship between women's T and facial and vocal attractiveness, since masculine faces and voices tend to be considered less attractive in women (Feinberg et al., 2008; Jones, Little, Watkins, Welling, & Debruine, 2011; Perrett et al., 1998; Puts, Barndt, Welling, Dawood, & Burriss, 2011). Surprisingly, associations between women's T levels and their attractiveness have yet to be investigated.

Age is another strong correlate of female reproductive potential. Women's fecundity is low in their teens, peaks in their mid-20s, and gradually declines to zero at menopause around age 45 (Menken et al., 1986). Likelihood of miscarriage mirrors this curvilinear pattern, with the greatest risks experienced by women under 20 or over 35 (Andersen et al., 2000). Men's mate preferences seemingly track these trends in female reproductive potential (Buss, 1989; Kenrick & Keefe, 1992). In contrast to fecundity, women's residual reproductive value (expected future offspring) peaks at reproductive maturity and declines thereafter. Correspondingly, researchers have consistently reported negative associations between female perceived or actual age and facial attractiveness (Fink, Grammer, & Matts, 2006; Jones & Hill, 1993; McLellan & McKelvie, 1993), including a study in which teenage female faces were rated along with young adult and older adult faces (Röder, Fink, & Jones, 2013). Few researchers have investigated age and vocal attractiveness, though Collins and Missing (2003) found that female voices perceived as more youthful were judged to be more attractive, and Röder et al. (2013) found that the voices of women aged 19–30 were rated as more attractive than those of girls aged 11–15 and women aged 50–65.

Body mass index (BMI), defined as body mass (in kg) divided by height (in m) squared (Tovée, Reinhardt, Emery, & Cornelissen, 1998), may positively predict female fecundity among foragers (Ellison, 2003; Hill & Hurtado, 1996), where men tend to prefer women with higher BMIs (Sugiyama, 2004; Wetsman & Marlowe, 1999; Yu & Shepard, 1998). Men in such populations may utilize body fat as an indicator of a woman's energetic reserves available for bearing and nursing offspring. In industrial populations, where procuring sufficient food is less exigent, both low and high levels of BMI are associated with decreased female fertility (Grodstein et al., 1994; Rich-Edwards et al., 1994; Veleva et al., 2008). Men in these populations tend to prefer women of moderate BMI (Tovée, Hancock, Mahmoodi, Singleton, & Cornelissen, 2002; Tovée, Maisey, Emery, & Cornelissen, 1999). Given these context dependencies, BMI should positively predict facial and vocal attractiveness in foraging societies, and negatively predict facial and vocal attractiveness in industrial societies with a high mean BMI. Among Western women, a negative relationship between BMI and facial attractiveness has been reported by some studies (Collins & Missing, 2003; Davis, Shuster, Dionne, & Claridge, 2001; Hume & Montgomerie, 2001), yet others have

reported no significant relationship (Hönekopp, Bartholomé, & Jansen, 2004; Thornhill & Grammer, 1999). Studies that examine facial adiposity (a correlate of BMI; Tinlin et al., 2013) provide more consistent results. Greater facial adiposity has been negatively associated with facial attractiveness (Coetzee et al., 2012), as well as indicators of physical and reproductive health (Coetzee, Perrett, & Stephen, 2009; Coetzee, Re, Perrett, Tiddeman, & Xiao, 2011; Tinlin et al., 2013). Associations between BMI and vocal attractiveness have received much less attention, and the few studies on this topic have produced mixed results (Collins & Missing, 2003; Hughes, Dispenza, & Gallup, 2004). No study of which we are aware has investigated these relationships among foragers.

In sum, associations between individual variation in women's reproductive potential and their facial and vocal attractiveness are not well established. Yet, if women's faces and voices are cues to fecundity and reproductive value, then T, age, and BMI should predict women's facial and vocal attractiveness. Some relevant associations have been studied insufficiently or not at all, and, where associations have been explored, results are inconsistent, which have hindered firm conclusions. Moreover, most samples have been drawn from Western universities. Because such populations are relatively buffered from environmental stressors, including pathogenic infection and nutritional deficit, the expression of mate quality indicators may be less variable than in populations leading more traditional lifestyles.

We examined relationships between the indicators of reproductive potential discussed above (testosterone, age, and BMI) and facial and vocal attractiveness in women 18 years and older from both industrial (Study 1) and foraging (Study 2) populations. Specifically, we predicted that women's (1) T levels would negatively predict facial and vocal attractiveness; (2) age would relate negatively linearly and/or negatively quadratically to attractiveness, with vocal and facial attractiveness peaking between sexual maturity in the mid-teens and peak fecundity in the mid-20s; and (3) BMI would relate to facial and vocal attractiveness negatively in the industrial population and positively in the foraging population.

2. Study 1: U.S. Sample

2.1. Methods

2.1.1. Participants

Three hundred forty-eight women (194 taking hormonal contraception) participated in this research as part of a larger study involving siblings. This study was approved by the ethics board at Michigan State University and is in accord with the Helsinki Declaration. The mean age (\pm SD) of the participants was 20.0 \pm 1.6 years (range 18–27). Self-reported ethnicities were 92.4 percent White, 3.0 percent Asian, 1.0 percent Hispanic or Latino, 1.0 percent Black or African American, 0.3 percent Native Hawaiian or Other Pacific Islander, 0.5 percent American Indian or Alaska Native, and 1.9 percent Other.

2.1.2. Procedures

Naturally-cycling participants were scheduled for two laboratory sessions according to self-reported menstrual cycle length and date of the beginning of the last menstrual bleeding. One session was scheduled to coincide with participants' late follicular phase, and the other was scheduled to occur during the mid-luteal phase, according to the methods of Puts (2006). Session order was counter-balanced across participants, and sessions occurred between 1300 h and 1600 h to minimize any influence of circadian hormonal fluctuations.

Because cyclic changes in E and P potentially confound relationships between T and attractiveness (Puts et al., 2013), we examined the influence of T in women taking oral contraception (OC), whose cyclic hormonal variation is suppressed. To capture diurnal T

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