Female Sexual Advertisement Reflects Resource Availability in Twentieth-Century UK Society

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Evolutionary theory suggests that men and women differ in the characteristics valued in potential mates. In humans, males show a preference for physical attractiveness, whereas females seek cues that relate to resources and future earning potential. If women pursue marriage as an economic strategy, female sexual advertisement should increase during periods of poor economic conditions when the number of high-quality male partners becomes a limited resource. To test this prediction, measures of skin display and clothing tightness were taken for clothes portrayed in UK *Vogue* magazine from 1916 to 1999. These estimates of sexual advertisement were analyzed in relation to an index of economic prosperity (GDP), while controlling for general increases in economic conditions and sexual display over the course of the past century. The results indicate that female sexual display increases as economic conditions decline, with the level of breast display and the tightness of clothing at the waist and hips the key factors underlying this increase. Breast size and symmetry and female body form are secondary sexual characteristics that play an important role in sexual attractiveness. Since advertisement of these features increases as levels of competition for high-quality partners increases, females appear to use mar-

riage as an economic strategy. Patterns of female fashion appear to be underpinned by evolutionary considerations relating resource availability to female reproductive success.

KEY WORDS: Breast asymmetry; Mate choice; Sexual display; Waist-to-hip ratio

Darwin (1871) first suggested that mate choice and sexual selection might be important evolutionary considerations in relation to human reproductive behavior. Intersexual selection, where traits evolve in one sex that are attractive to the opposite sex, is traditionally taken to refer to "female choice," since females, as the sex with higher parental investment, are expected to be more choosy when selecting mates (Bro-Jorgensen 2002; Matsumoto-Oda 1999). In humans, however, where male parental investment may be substantial (Singh 1995a), males are also found to exert choice, particularly in mating systems that tend towards monogamy (Buss and Barnes 1986).

Men and women differ with regard to characteristics valued in a potential mate (Buss 1989) and actual matings (Kenrick and Keefe 1992; Pérusse 1994). Typically, females are said to value resources in a mate that will have a positive effect on fitness through investment in herself and her offspring, whereas males value physical attractiveness and youth as indicators of fecundity (Buss 1989; Buss and Barnes 1986; Townsend 1989). A number of secondary sexual characteristics, such as enlarged breasts, buttocks, and hips accompanied by a slender waist, are considered attractive and indicators of female quality (Gitter et al. 1983). These "ornaments" of sexual selection (Barber 1995) play an important role in female reproductive success owing to their significance in attracting a desirable partner. Grammer et al. (1993) found female skin display and figure exposure to increase around ovulation, and in situations where potential mates were more likely to be encountered, suggesting that female clothing and skin displays have an active role in female mate choice. As a consequence we would expect females to wear clothing that emphasizes their body shape and physical attractiveness, particularly when there is competition for access to males.

Since earning capacity is often taken to reflect resource availability in modern human societies, the level of female competition for access to males should covary with general measures of economic prosperity, since this is likely to reflect the availability of "high-quality" potential mates. Silverstein et al. (1986) found that, in an analysis of models, the degree of curvaceousness (bust-to-waist ratio) seen as ideal by women was inversely correlated with economic opportunities for women (indexed by the number of women graduates and women entering the workforce), suggesting that females accentuate their feminine morphology when economic prospects are bleak.

The first study to assess the relationship between female fashion and environmental factors was Mabry's (1971, cited in Barber 1999) investigation of the dress lengths of models in women's magazines. This study found that dress lengths over a

50-year period correlated with the Dow Jones Industrial Average, with dresses becoming shorter as stock prices rose. More recently, Barber (1999) used data from three studies of female fashion and concluded that short skirts (signaling sexual accessibility) were associated with low sex ratios (limited marital opportunities), increased employment opportunities for women, and marital instability, with narrow waists and low necklines (signaling reproductive value) showing opposite relationships. While these results suggest that fashion styles are dependent on environmental conditions, there are some problems with this interpretation on the basis of Barber's (1999) study.

Although we do not agree with all of the hypotheses and predictions proposed by Barber (1999), a detailed discussion of our differences is not within the scope of this paper. Instead we will focus on testing the hypothesis that women should advertise their feminine morphology (through more revealing and tight-fitting clothing) when economic prospects are poor. Some problems with the approach adopted by Barber (1999) need to be addressed, however, since the correlation between fashion trends and marital economies could simply result from both variables being associated with a third variable. For example, over the past century divorce rates (Goldstein 1999; Ruggles 1997) and the number of females graduating from college (Rowe and ByongSuh 1997; Yano 1997) have both increased, as have the Dow Jones Industrial Average (Pierce 1991) and general measures of the state of the economy (such as the real per capita Gross National Product: Diamond and Guilfoil 1973). If the levels of "acceptable" female sexual advertisement (through short skirts or low necklines) have also increased owing to a relaxation of social attitudes, female fashion and environmental variables will inadvertently be correlated without any direct causality. A second issue is that time lags are likely to exist between environmental conditions and their influence on fashion or standards of bodily attractiveness (see Silverstein et al. 1986). As a consequence, a detailed analysis of the relationship between female fashion and marital economies not only must control for general trends in fashion and the environment over the range of the data but also must consider the importance of time lags in determining female fashion trends.

Here we present data on female fashion trends and skin exposure to examine the hypothesis that levels of female skin display and sexual advertisement are linked to the degree of competition for mates. We use economic conditions in the United Kingdom throughout the twentieth century as an index of the level of female-female competition to test the specific prediction that female sexual advertisement (through more revealing and tight-fitting clothing) should increase as economic conditions decline and competition for mates increases. In doing so, we control for general trends in fashion design and economic variables over the course of the past century and incorporate time lags between environmental conditions and female sexual advertisement.

METHODS

Economic Data

Gross domestic product (GDP) figures for the UK, which measure the total economic activity within the economy, were used to assess relative resource availability over the past century. GDP figures for 1900 to 1983 were taken from Liesner (1985) and figures from 1948 to 2000 were taken from the UK Office for National Statistics (the overlapping ranges were used to ensure that values were consistent). All GDP figures were scaled to constant (1995) prices to produce a continuous scale from 1900 to 2000. In practice, scaling to any year in the range would give identical results. Furthermore, since GDP is related to many other measures of economic prosperity, such as the Average Earnings Index, similar results would be anticipated for a range of economic variables.

GDP has increased steadily over the course of the past century (Figure 1), and this general increase may obscure more subtle trends that occur between years. It is clear that the GDP figures from the periods coinciding with the two world wars show elevated levels of economic activity. These years can be very misleading; on the one hand, GDP may be boosted by military expenditure, on the other, it may be depressed by destruction of factories and other economic activities (Matteo Iannizzotto, Lecturer in Economics, University of Durham, personal communication 2001). As a consequence, economic data from the two world wars were excluded from all subsequent analyses.

Since we are interested in identifying relative economic prosperity that is independent of the general trend of economic growth, studentized deleted residuals were taken from a cubic regression fit of GDP over the past century (Figure 1: $r^2 = 0.996$, $F_{2,73} = 8828.31$, $p < 0.0001$). The mean residual GDP of the five years preceding the study year was taken as the independent variable against which the dependent variables related to female sexual advertisement were assessed. The justification for this is twofold. Firstly it was assumed that time lags were likely to be important in determining fashion trends, since clothes are not necessarily designed in the year that they are marketed (see also Silverstein et al. 1986). Secondly, it was also assumed that economic trends over a small number of years were likely to outweigh the impact of any single year prior to that for which the fashion data are available. As a consequence, an economic variable that reflects the average conditions in the years prior to the year that the fashion designs are marketed is likely to be most appropriate.

Skin Exposure and Clothing Tightness

Estimates of skin display and tightness of clothing were taken from photographs of female fashion models, advertisements, and line drawings of clothing pattern models from available copies of *Vogue* magazine from 1916 to 1999. Analyses were

Figure 1. Gross domestic product (GDP) figures (scaled to 1995 [GDP = 100] prices) for the United Kingdom for 1900 to 2000. Solid circles indicate GDP figures from the two world wars.
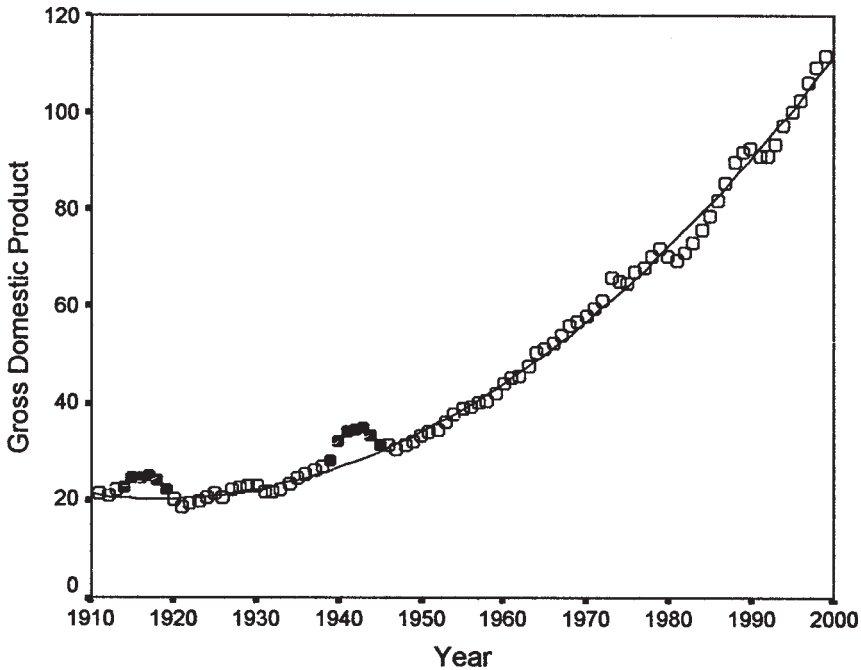
restricted to fashion images from this magazine to minimize any confounding effects arising from different magazines being targeted to different markets. To estimate skin exposure, acetate graph paper was laid over each individual picture, and the areas of the body exposed and covered by clothing were calculated, with the head and feet excluded. Exposed area counts were made for the body as a whole, with the percentage of arm, leg, and upper torso exposed also recorded separately so that trends relating to specific body areas could be assessed. To assess clothing tightness, categorical estimates were made at the chest, waist, and hip using a four-point scale (1: second-skin, 2: clingy, 3: fitted, 4: loose). To minimize measurement error resulting from odd body positions or cropped pictures, only full-length body photographs were used in which the model was facing directly forward. Furthermore, to reduce the impact of clothing style on fashion trends and skin exposure, pictures were only selected if the clothing type was a dress (rather than a skirt and top). Finally, data were restricted to eveningwear or daywear, and only pictures with specific reference to either of these two clothing styles were included. A minimum of two pictures for each of the two clothing styles was randomly selected for each year from 1916 to 1999, with mean skin exposure and median clothing tightness category employed as dependent variables.

Skin display has increased linearly over the course of the past century, both for

the body as a whole ($r^2 = 0.457$, $F_{1,80} = 67.42$, $p < 0.0001$) and for the arms and legs independently (arms: $r^2 = 0.092$, $F_{1,80} = 8.11$, $p = 0.006$; legs: $r^2 = 0.463$, $F_{1,80} = 68.96$, $p < 0.0001$), although the relationship was not significant for upper body alone ($r^2 = 0.000$, $F_{1,80} = 0.04$, $p > 0.80$). These trends are likely to reflect changes in social attitudes over the course of the past century rather than a response to resource availability. To control for this fact, all subsequent analyses of skin display were based on studentized deleted residuals of skin display controlling for year. Data were subsequently excluded for 1986, since casewise diagnostics on the linear regression models indicated that residual skin exposure values for this year were outliers exceeding 2 standard deviations in three of four analyses. This suggests that random sampling effects may have produced values for this year that do not accurately reflect the overall patterns of fashion and skin exposure. Nevertheless, if these data are retained the results are virtually identical. No measures of clothing tightness correlate with year (chest: $r_s = -0.215$, $n = 82$, $p > 0.05$; waist: $r_s = -0.044$, $n = 82$, $p > 0.60$; hip: $r_s = 0.007$, $n = 82$, $p > 0.90$), and as a consequence subsequent analyses with clothing tightness are conducted on the raw data.

One final issue that needs to be addressed is whether the clothing trends depicted in *Vogue* magazine reflect the actual female clothing choices and preferences at any given time. There is an increasing body of evidence to suggest that clothing styles are not simply undergoing arbitrary autonomous cyclical changes but are at least partially moderated by some external sociocultural factor (Lowe and Lowe 1982). Furthermore, the preeminent standing of *Vogue* magazine relies on its ability to pick up on tacit sociocultural changes as they become apparent in women's fashion. The reputation and longevity of the magazine confirms its success in exemplifying twentieth-century female fashion trends (Crane 2000) and thus its suitability as a data source for studying fashion change (Docherty et al. 2000). *Vogue* magazine is thus a precise reflection of contemporary fashion such that the patterns and results presented here accurately mirror actual fashion trends.

RESULTS

Skin Exposure

Figure 2 displays the relationship between economic prosperity and total skin exposure over the past century. It is clear that female sexual display increases under poor economic conditions, since a significant negative relationship exists between total body exposure and mean residual GDP for the five years preceding the fashion year ($r^2 = 0.128$, $F_{1,60} = 8.79$, $p < 0.005$). Not all body areas contribute equally to this relationship. Upper body exposure appears to be of primary importance, since this shows the strongest relationship with economic prosperity (Figure 3a: $r^2 = 0.165$, $F_{1,60} = 11.88$, $p = 0.001$). There is also a weaker relationship with arm exposure (Figure 3b: $r^2 = 0.075$, $F_{1,60} = 4.86$, $p < 0.04$), further suggesting that it is upper body exposure that is important. No significant relationship exists for leg exposure (Fig-

Figure 2.   Relationship between percentage skin exposure for the whole body and economic prosperity.
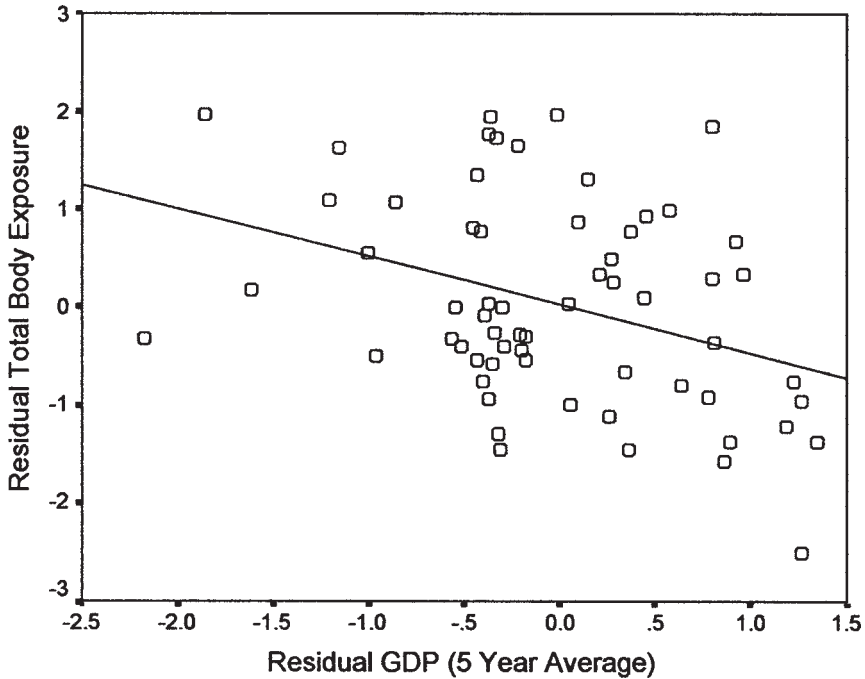
ure 3c: $r^2 = 0.044$, $F_{1,60} = 2.74$, $p = 0.10$), although the trend is in the predicted negative direction.

Clothing Tightness

In terms of relationships with clothing tightness, chest, waist and hip tightness all show positive associations with economic prosperity, with clothing becoming progressively tighter (low tightness scores) as economic conditions decline. There are significant positive correlations between economic conditions and the tightness of clothing at the waist ($r_s = 0.280$, $n = 63$, $p = 0.026$) and hips ($r_s = 0.275$, $n = 63$, $p < 0.03$). Contrary to the results for skin exposure, however, there is no significant relationship with chest tightness ($r_s = 0.208$, $n = 63$, $p = 0.10$).

DISCUSSION

Female secondary sexual characteristics are thought to be indicators of female quality (Gitter et al. 1983) and play an important role in attracting a desirable partner and thus female reproductive success (Barber 1995). The results presented here clearly illustrate that twentieth-century fashion trends emphasize female sexual morphology

Figure 3. Relationship between economic prosperity and (*a*) upper body exposure, (*b*) arm exposure, and (*c*) leg exposure.
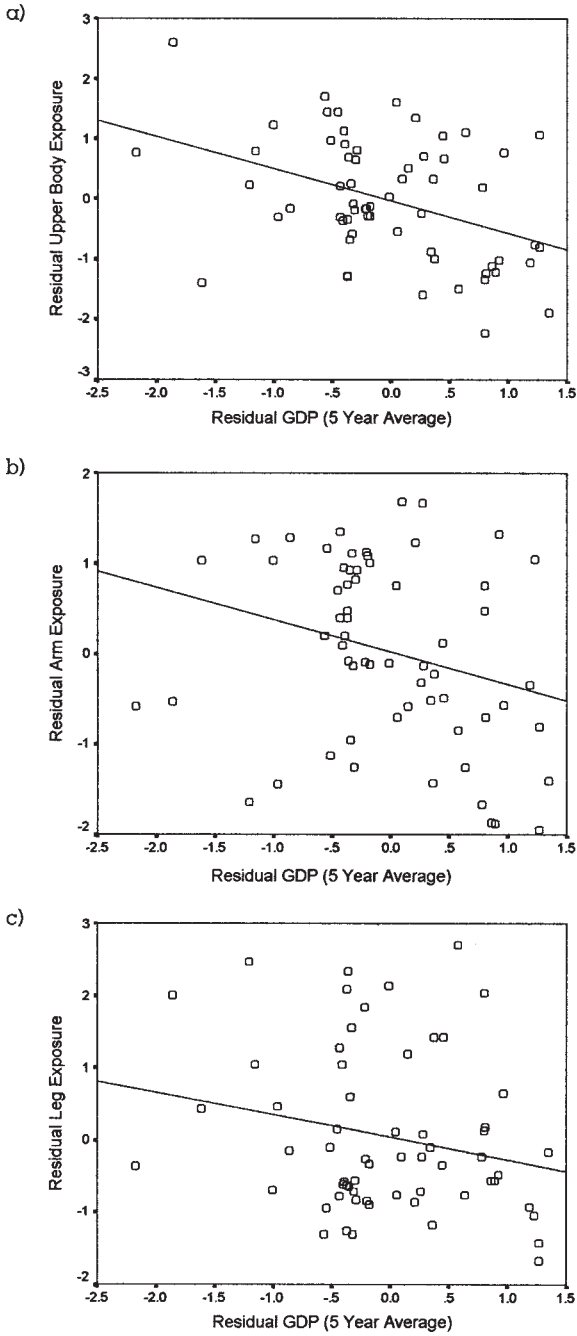
under poor economic conditions. Female clothing exposes more skin in situations where there are likely to be fewer "high-quality" mates available, confirming the idea that this represents active female choice in attracting mates (Grammer et al. 1993). In part this may reflect the value of skin texture as a cue to female fertility and health (Fink et al. 2001).

The finding that upper body display is the primary region underlying the relationships with skin exposure suggests that breast display is important in advertising reproductive value (Symons 1979). The value of breasts as a sexual signal is likely to be twofold. Firstly, since the development of permanent breasts occurs in females at puberty it provides an honest signal of reproductive capacity. Singh and Young (1995) thus suggest that relatively small breasts should be indicative of young, pre-reproductive females, such that larger breasts should be preferred as indicators of reproductive status. There is some evidence that males do prefer large breasts (Gitter et al. 1983), although Tantleff-Dunn (2002) found that males perceived a female of intermediate breast size more favorably on both social and professional scales. Thus while male preferences for breast size are unlikely to be for very large breasts, and the sexual appeal of breast size is likely to depend on the slenderness of the female (Low et al. 1987), it is nevertheless clear that breast size is an important element of female sexual display.

A second potential importance of breast display relates to the fact that breast symmetry correlates with fertility (Thornhill and Gangestad 1994). Møller et al. (1995) found breast asymmetry to be negatively correlated with number of children, even after controlling for weight, height, age, and breast size of the females. Breast asymmetry is thus a reliable predictor of age-independent fecundity, and increased display of this region would thus be anticipated as competition for access to high-quality male partners increases. Since both breast size and symmetry could be concealed or manipulated by clothing, upper body skin display, rather than clothing tightness, would be anticipated to increase as female-female competition increases to ensure honesty of the signal.

Clothing tightness shows similar trends as skin display with respect to economic prosperity, with female clothing generally tighter under relatively poor economic conditions. In particular, clothing becomes tightest around the waist and hips. Waist-to-hip ratio (WHR) is a secondary sexual characteristic that reflects reproductive potential and is a reliable indicator for disease risk, sex hormone profile, age, and fertility (Singh 1995b; Zaadstra et al. 1993). Humans should possess evolved mechanisms for assessing WHR in mate choice decisions (Singh 1995b), and a number of studies have reported male preferences for specific waist-to-hip ratios (Furnham et al. 1997; Singh 1993a, 1993b, 1995b; Streeter and McBurney 2003). The fact that the increase in clothing tightness during poor economic periods is greatest at the waist and hips thus reflects its importance.

Recently it has been suggested that the body mass index (BMI) may be more important in sexual attractiveness than WHR (Tovée et al. 1999). Since BMI has a strong impact on health (Kim et al. 2000) and reproductive potential (Lake et al.

1997), it should provide a reliable cue to female reproductive value, and recent studies have shown BMI to be a better predictor of female attractiveness than WHR (Tovée et al. 1999, 2002). Although BMI and WHR are significantly correlated (Tovée et al. 2002), it is likely that tight clothing would be required to assess female BMI directly even if is less inherently visual than WHR. However, Tovée et al. (1999) suggest that the perimeter area ratio (PAR—the path length around the perimeter of a figure divided by the area) would provide an accurate visual proxy of BMI. Tight clothing is essential for females to advertise these cues honestly, and thus clothing would be anticipated to become tighter in response to declining economic conditions as the intensity of female-female competition increases.

Breast size and body form are thus secondary sexual characteristics that play an important role in female sexual attractiveness. Furthermore, these are also features that can be better assessed from a distance, suggesting their value as a distal cue (Singh 1995a), and are precisely the regions advertised as females accentuate their feminine morphology when economic prospects are bleak. Although the relationships presented here relate to dresses, we would anticipate the relationships to hold true for other clothing types, and females to switch between clothing types on the basis of their value for sexual display as economic conditions vary. Patterns of twentieth-century UK fashion and skin display thus appear to be driven by economic prosperity and underpinned by evolutionary considerations of the importance of female secondary sexual characteristics in mate attraction and female reproductive success.

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