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Scientific discoveries as cultural displays: a further test of Miller's courtship model

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Abstract

The biographies of 280 scientists demonstrate that the age distribution of their career peaks is identical to those of jazz musicians, painters, and writers, and that this universal age profile holds only among scientists who were married some time in their lives. I interpret this as support for Miller's cultural display model in an evolutionarily novel environment.

Keywords: Scientific discoveries; Miller's courtship model; Cultural display

Miller (1998, 1999) argues that culture is a byproduct of sexual competition for mates, where individuals advertise their fitness by displaying their desirable phenotypes (genius, creativity, and taste). His courtship model of cultural display makes two specific predictions. First, there should be strong sexual dimorphism in the tendency toward such display and to produce culture, because men compete for their mates much more fiercely than women (Daly & Wilson 1988, pp. 137–161). Second, "cultural production should increase rapidly after puberty, peak at young adulthood when sexual competition is greatest, and gradually decline over adult life as parenting eclipses courtship" (Miller, 1999, p. 81).

His data on the producers of jazz albums, modern paintings, and books support these predictions. Men produce 20 times as many jazz albums, 8 times as many modern paintings, and 3 times as many books as women. In each case, men's cultural production rapidly increases after puberty, peaks in early to middle adulthood, and declines throughout

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adulthood. Miller (1999, pp. 82–86) states that the same age–sex profile holds for rock albums, classical music, old paintings, plays, and philosophical tracts.

At the end of his chapter, Miller (1999, p. 87) expands the scope of his model.

> A strong version of my cultural courtship model would make the following prediction: this universal profile will be found for every quantifiable human behaviour that is public (i.e. perceivable by many potential mates) and costly (i.e. not affordable by all sexual competitors). This universal profile may even apply to evolutionarily novel behaviours such as skydiving, playing one's car stereo at high volume, and constructing an elaborate 'home page' on one's Internet web site. If the universal profile is replicated for other genres, other media, other cultures and other historical epochs, it could be interpreted as an evolved, species-typical, sexually dimorphic, life-history adaptation, shaped by sexual selection and fundamental to understanding the distribution of cultural behaviour in our species.

One evolutionarily novel behavior that fits this scope is scientific research. Scientific discoveries are quantifiable (by the number of articles, awards and grants), public (news of scientific discoveries routinely makes the headlines; *Time* magazine's celebrated Person of the Century was Albert Einstein), and costly (one needs to invest decades of schooling and formal training in order to conduct scientific research). Scientific discoveries therefore fit the scope of the strong version of Miller's courtship model.

In order to examine the age–sex profiles of the producers of scientific discoveries, I studied the biographies of 280 scientists (mathematicians, physicists, chemists, and biologists) in *The Biographical Dictionary of Scientists* (Porter, 1994). There are a few scientists from the 16th and 17th centuries, but the overwhelming majority comes from the 18th century to the present. The biography of each scientist in this dictionary follows the same format. The first paragraph lists the scientist's name, years of birth and death, nationality and field of research, and the most significant scientific contribution in the entire career. The next one or two paragraphs detail the scientist's educational career and the history of institutional affiliations. Then the next few paragraphs summarize the research career, enumerating the dates of major discoveries and publications. I use the date of the discovery or experiment that is listed in the first paragraph as the scientist's most significant contribution to denote the *peak* of the career. I then calculate the scientist's age at the peak, by subtracting the year of birth from that of the peak.

I measure cultural production slightly differently from Miller. His cultural producers were able to contribute multiply into his data. For instance, his data on jazz albums include 1892 albums by 719 musicians. In contrast, my scientists can contribute only once into my data; there are 280 scientists, and 280 data points. However, Simonton's (1988, 1997) *equal-odds rule* demonstrates that scientists make the most significant contributions when they make the largest number of contributions. These two measures (of quality and quantity) are thus equivalent and, if Miller's model is true, the universal profile should still be apparent with my data.

Recall that Miller's courtship model makes two specific predictions: sexual dimorphism and the age curve. Of the 280 scientists in my sample, 273 (97.5%) are male and only 7 (2.5%) are female. This is far more sexually dimorphic than jazz musicians,

modern painters, and authors. While my data on scientists therefore confirm Miller's first prediction, perhaps the fact that an overwhelming majority of scientists are male is not surprising. The second prediction will therefore provide a better test of the courtship model.

Fig. 1 presents the distributions of the age of peak scientific achievement separately for male and female scientists. The bottom histogram for the 273 male scientists clearly shows the same age profile that Miller found for cultural producers. The mean age of peak scientific achievement among male scientists is 35.4, the median is 33.0, and the interquartile range (the distance between the 25th and the 75th percentiles, encompassing the middle 50% of the distribution) is 12.0 years.

I have performed one additional test for the courtship model. If cultural display declines through adulthood because, during these years, "parenting eclipses courtship," then this pattern should only hold for men who have successfully mated and reproduced. There is no reason for men who have not been reproductively successful to cease their cultural displays. Fig. 2 presents the age distributions separately for male scientists who were married some time in their lives (n=182) and for those who remained single for their entire lives (n=70). (I used Debus (1968) and Gillispie (1970–1980) for information on the scientists' marital history, but I could not ascertain the marital history of 21 male scientists.) The histograms clearly show that the universal profile only holds for married scientists. The age curve among

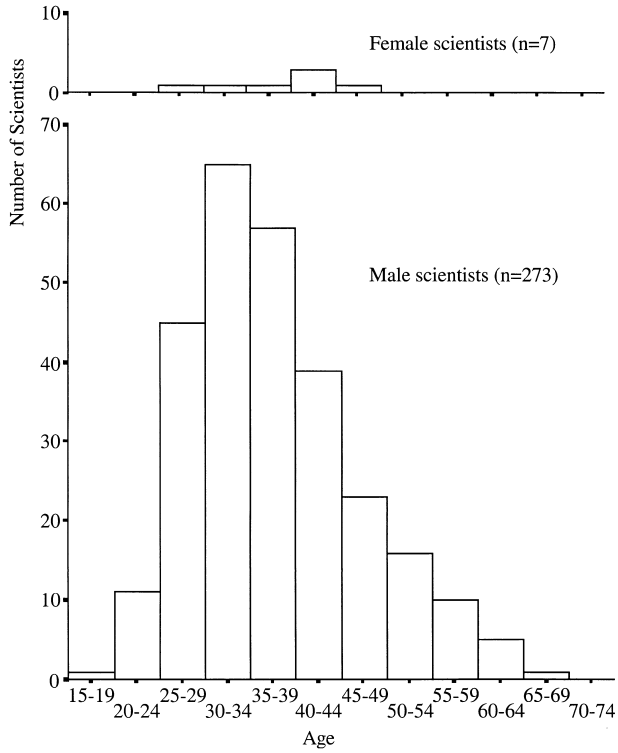

Fig. 1. The age of peak scientific achievement.

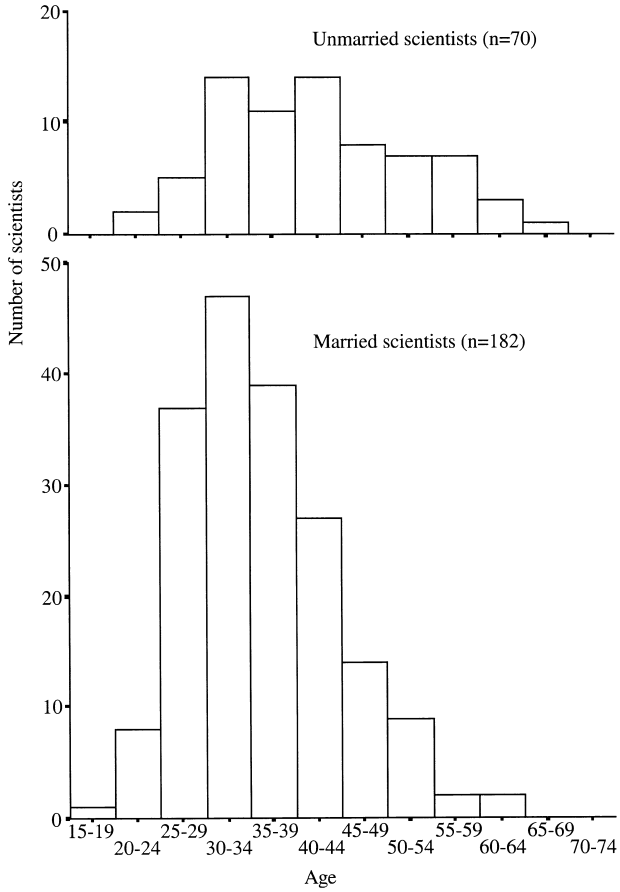

Fig. 2. The age of peak scientific achievement, male scientists.

these scientists is essentially the same as that for the entire sample, but the peak occurs a bit earlier in an even quicker burst (mean=33.9, median=32.5, IQR=11.25). In contrast, scientific achievement among scientists who never married does not decline sharply. Half as many (50.0%) unmarried scientists make their greatest contributions in their late 50s as they do in their late 20s. The corresponding percentage among the married scientists is 4.3%. The mean peak age among the unmarried scientists is 39.9, the median is 38.5, and the IQR is 17.75. The difference in the mean age between the married and unmarried scientists is statistically significant ($t=4.14$, $df=101.33$ under the unequal variances assumption, $p<0.0001$).

Scientific research is an evolutionarily novel behavior. Yet men's evolved psychological mechanism appears to be rather precisely tuned to marriage as a cue to desistance from cultural display. Nearly a quarter (23.2%) of all male married scientists make their greatest contributions within 5 years after their marriage. The mean *delay* (the difference between their marriage and their peak) is a mere 2.5 years; the median is 3.0 years. It appears that scientists quickly cease their cultural displays after their marriage, while unmarried scientists

continue to make great scientific contributions later in their lives. This pattern is perfectly consistent with Miller's courtship model of cultural display.

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