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Parent–offspring conflict over mate choice: An experimental study in China

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Both parents and offspring have evolved mating preferences that enable them to select mates and children-in-law to maximize their inclusive fitness. The theory of parent–offspring conflict predicts that preferences for potential mates may differ between parents and offspring: individuals are expected to value biological quality more in their own mates than in their offspring's mates and to value investment potential more in their offspring's mates than in their own mates. We tested this hypothesis in China using a naturalistic 'marriage market' where parents actively search for marital partners for their offspring. Parents gather at a public park to advertise the characteristics of their adult children, looking for a potential son or daughter-in-law. We presented 589 parents and young adults from the city of Kunming (Yunnan, China) with hypothetical mating candidates varying in their levels of income (proxy for investment potential) and physical attractiveness (proxy for biological quality). We found some evidence of a parent–offspring conflict over mate choice, but only in the case of daughters, who evaluated physical attractiveness as more important than parents. We also found an effect of the mating candidate's sex, as physical attractiveness was deemed more valuable in a female potential mate by parents and offspring alike.

The parent–offspring conflict theory postulates that a conflict between parents and offspring can arise from the difference between the parental investment the offspring wants to receive and the investment the parent wants to give to a particular child (Trivers, 1974). This is due to parental investment increasing the fitness of the selected offspring while decreasing the parent's ability to invest in other (existing or future) offspring. As noted by Trivers (1974), this phenomenon of parent–offspring conflict may be extended further to include the mate choice of offspring. Parents exercise strong control over the mating decisions of their offspring in many societies and there is evidence that this has been the case during most of our evolutionary past, suggesting that parents' preferences for their offspring's mates may have been a substantial evolutionary force (Apostolou, 2007b, 2010b, 2012, 2017; Buunk, Park, & Duncan, 2010; Buunk & Solano, 2010).

As parents and offspring are not genetically identical, the traits of a mating candidate which maximize the inclusive fitness of the parents do not necessarily maximize the

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inclusive fitness of the offspring. It has been hypothesized that parents have a relatively stronger preference for offspring's mates with characteristics suggesting parental investment (in caring or resources), whereas their offspring have a relatively stronger preference for mates with characteristics signalling heritable fitness (Apostolou, 2007b, 2008, 2010b, 2017; van den Berg, Fawcett, Buunk, & Weissing, 2013; Buunk *et al.*, 2008; Buunk & Solano, 2010; Buunk, Park, & Dubbs, 2008; Dubbs & Buunk, 2010; Schlomer, Del Giudice, & Ellis, 2011). Characteristics signalling heritable fitness can be generalized to what we call here 'biological quality', which includes any trait increasing the number, survival, and reproduction of the descendants: fertility, health, 'good genes', etc. A high biological quality in the offspring's partner contributes to parents' fitness only through the offspring's own descendants. In contrast, the benefits coming from high investment can be shared to some extent by other family members (e.g., siblings). But more importantly, if the offspring's partner is not an adequate provider, the parents have to compensate by spending time and resources; this inevitably limits their ability to invest in other children and grandchildren (van den Berg *et al.*, 2013; Buunk & Solano, 2010; Buunk *et al.*, 2008; Dubbs & Buunk, 2010; Schlomer *et al.*, 2011).

Of course, biological quality benefits parents as well so that parents' and offspring's preferred characteristics should overlap. If an individual can find a mate with both high biological quality and high level of investment potential, parents' and offspring's choice will match. What is expected to differ between parent and offspring is the relative weighting of particular characteristics: a conflict could arise only if a trade-off between biological quality and investment is involved (Apostolou, 2017; van den Berg *et al.*, 2013; Dubbs & Buunk, 2010; Schlomer *et al.*, 2011).

Note that we do not need to postulate any biological or intrinsic trade-off between these two qualities (although there is some evidence that this kind of intrinsic trade-off may exist: for a review see Buss & Schmitt, 1993; Gangestad & Simpson, 2000), but only a somewhat independent variation of these two traits, leading to different combinations of these traits in the population. Because of competition, individuals displaying a high biological quality together with an elevated level of investment will be more difficult to obtain and mate choice will inevitably involve a compromise, such that pursuing one type of benefit (e.g., biological quality) reduces the likelihood of obtaining another type of benefit (e.g., investment potential). According to the parent-conflict theory, parents and offspring are expected to differ in the compromises they are willing to make.

These predictions have received initial support from several survey studies in different countries (Apostolou, 2008, 2015b; Buunk & Solano, 2010; Buunk *et al.*, 2008; Dubbs & Buunk, 2010; Dubbs, Buunk, & Taniguchi, 2013; Guo, Li, & Yu, 2017; Park, Dubbs, & Buunk, 2009). However, these studies have some limitations. Most often, the parents interviewed were not actually looking for a partner for their offspring, for example in societies with minimal parental influence over mate choice, such as the United States, the UK, or the Netherlands. In some cases, their offspring were too young or already in a relationship; or the scenarios involved an imaginary son or daughter. In other studies, the parents' preferences were inferred from the offspring's perception of those preferences (Buunk & Solano, 2010; Buunk *et al.*, 2008; Dubbs *et al.*, 2013; Park *et al.*, 2009) or the reverse: parents reporting what they thought their offspring would prefer (Apostolou, 2008; Dubbs & Buunk, 2010). Consequently, the responses obtained were based on hypothetical scenarios, potentially quite far from reality. Moreover, in almost all these studies, participants had to rate several characteristics on a scale, which does not reflect the trade-offs that individuals may have to face in reality, a key point in the theory of parents–offspring conflict over mate choice.

In this study, we overcome some of these prior issues in the literature by directly (1) studying parents who are actively searching for partners for their offspring (thus avoiding artificial preferences); (2) asking parents and offspring for their own preferences (thus avoiding perceived preferences); (3) situating the mate choices within a context of direct trade-offs (thus avoiding non-ecological preferences). We thus build on the previous studies in exploring the parent-conflict theory. Specifically, we do so in China, a country where parents have a strong influence on their offspring's mate choice.

Arranged marriages were the dominant tradition in China for centuries: parents chose the spouse for their child, often with the help of a professional matchmaker (Huang, Jin, & Xu, 2017; Xia & Zhou, 2003; Xie & Combs, 1996). Since the beginning of the 20th century, a combination of increasing wage labour in China's cities and growing Western influence on China's culture and educational system began to promote young people's choices in mating decisions (Pimentel, 2000; Xiaohe & Whyte, 1990; Xie & Combs, 1996). After the Chinese communists came to national power in 1949, they vigorously promoted freedom of mate choice, making arranged marriages illegal (the Marriage Law, adopted in 1950). Moreover, the government helped to abolish the traditional marriage system by encouraging women to join the labour force (Pimentel, 2000; Xia & Zhou, 2003). The economic reforms of the late 1970s dramatically changed the life of the Chinese people as China became increasingly open to the rest of the world (Chang, Wang, Shackelford, & Buss, 2011; Higgins, Zheng, Liu, & Sun, 2002). However, despite a profound social revolution over the last three decades, Chinese parents continue to powerfully affect their offspring's marriages (Pimentel, 2000; Xiaohe & Whyte, 1990). As proof of parental influence on mate choice, a new phenomenon appeared in several Chinese cities around 10 years ago: the so-called *marriage markets*, platforms created to help parents find a marital partner for their adult children (see for example this one in Shanghai, http://news.bbc.co.uk/2/hi/asia-pacific/8063777.stm).

In this study, we use such a naturalistic marriage market in Kunming, the capital of the province of Yunnan in South China. Every Saturday in Kunming, one corner of the main public park (Green Lake Park) hosts a marriage market, a platform where individuals can search for a spouse. This platform, initiated by a few parents in 2005, has developed into an established event and mostly targets parents looking for a marital partner for their adult children. Parents and some other participants come to this marriage market to chat to each other, post the basic information of the individual to be married on the wall of the park, check the information of others on the wall, address one of the marriage agencies present at the park, or any combination of the above. These marriage search platforms used by parents or other relatives are a widespread but relatively new phenomenon in China.

We developed an experiment to investigate the existence of a parent–offspring conflict over mate choice in the case of a trade-off between biological quality and investment potential. We test the hypothesis that individuals give higher importance to biological quality when they choose a mate for themselves than when they choose a mate for their offspring (H1). We expect this difference to appear only in the case of a trade-off between biological quality and investment potential (H2). Finally, we expect to find a sex difference, with biological quality being more valued in a female potential mate and investment potential more valued in a male candidate, by both parents and offspring, reflecting general sex differences over mate choice (H3, see for instance Buss, 1989a; Buss & Schmitt, 1993; Li, Bailey, Kenrick, & Linsenmeier, 2002).

Material and methods

We created profiles of hypothetical mating candidates varying in their level of biological quality and investment capacity. We used facial attractiveness as a proxy for biological quality as there is substantial theoretical and empirical evidence that both are linked (for a review see Thornhill & Gangestad, 1999; Buss, 2015). Because the investment potential of an individual depends on the possession of sufficient resources, we used income to approximate investment capacity of the hypothetical candidates. We showed these hypothetical profiles to parents coming to the marriage market and asked them to choose the profile they would prefer as a long-term mate for their son or daughter. We then compared their choices to those of young individuals looking for a partner for themselves. This study is part of a larger project called 'Questionnaire for Search Activities for a Marital Partner in Yunnan', a cooperation between Yunnan Normal University (YNNU) and Institute of Advanced Study in Toulouse (IAST). The survey was approved by the Toulouse School of Economics Research Ethics Committee in April 2016. Formal permissions from the local government and from the Yunnan Normal University were also received.

Participants

From April to July 2016, 549 participants were recruited at the marriage market of Green Lake Park in the city of Kunming. In this sample, 75% of all participants were looking for a partner on behalf of someone else (who we will refer to as the *focus individual*) and around 23% were looking for a partner for themselves. Among people looking on behalf of someone else, nearly half of the respondents (49%) were looking for a partner for their daughter, 35% were looking for a partner for their son, 6% for their niece, 3% for a nephew, and the rest were other relatives or friends. We only kept parents looking on behalf of their offspring, as our study focuses on parent–offspring conflict. Moreover, we discarded data where the person to be married had already been married before (i.e., was widowed or divorced), as mating preferences can differ between a first and a second marriage. This constituted our '*parents*' group (N = 313). For anonymity reasons (and because some offspring were not aware that their parents were going to a marriage market for them), we were not able to collect the offspring's contact information. Instead, we interviewed individuals who had never been married, but were looking for a partner for themselves at the marriage market (N = 46). To complete this sample, we also interviewed 230 young individuals at the Yunnan Normal University in Kunming. Together, this constituted our '*offspring*' group (N = 276).

Stimuli

During the interviews, respondents were shown a pair of hypothetical profiles, each one including a facial picture and information on income, age, and city of residency (see Figure 1). One of the pictures showed an attractive individual and the other an unattractive individual. Each picture was a composite created using Webmorph software (DeBruine & Tiddeman, 2017), as an average of several facial photographs of Chinese individuals (mix of attractive people found on Chinese modelling websites, average individuals found on Chinese networking websites, and less attractive individuals found on websites showing individuals before plastic surgery). The pictures were rated for attractiveness using a different sample (N = 134) before the launch of the study to verify that the differences in attractiveness between the faces were significant (two-tailed t-test,

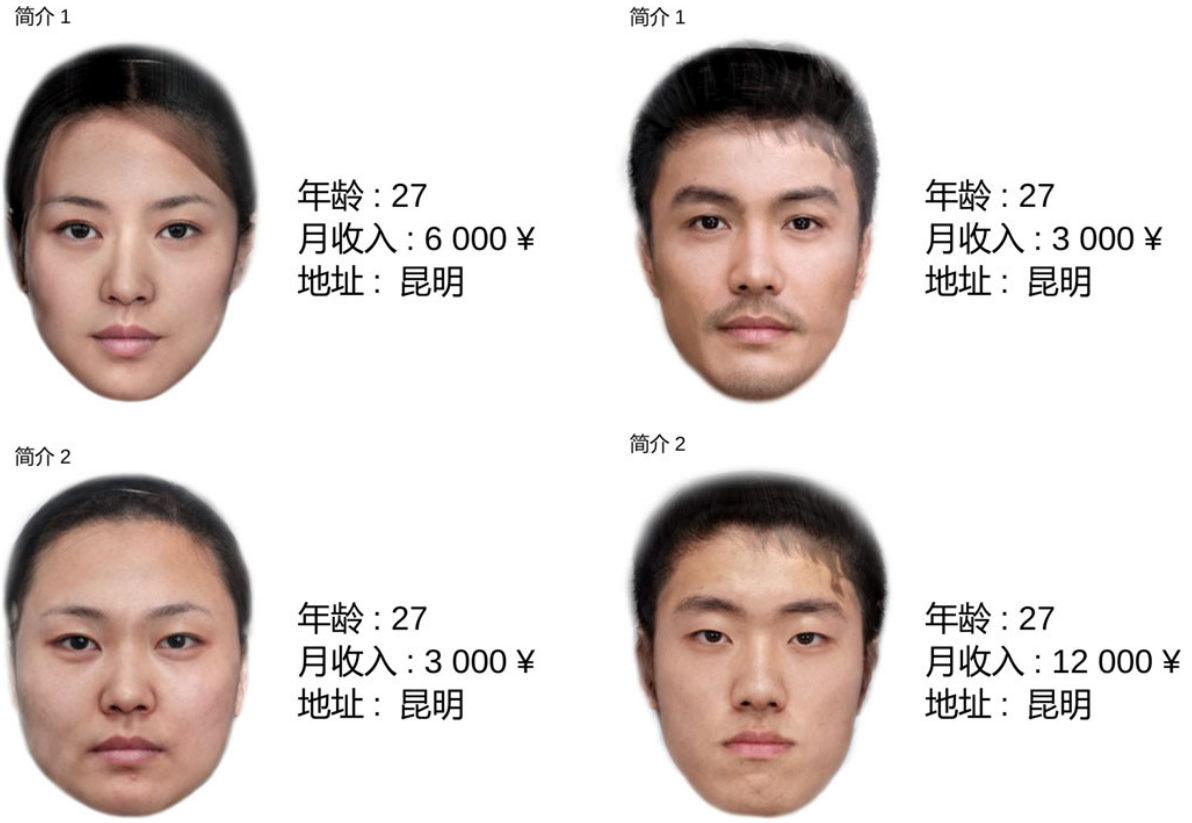

Figure 1. Example of pairs of hypothetical profiles for a male focus individual (left) and for a female focus individual (right). Translation: Age: 27/Income: . . .¥/Residency: Kunming. Attractive faces on the top line, and unattractive faces on the bottom line. The participants were asked to choose the profile they would prefer as a long-term partner for the focus individual (i.e., for their offspring or for themselves according to the group).

all $p < .001$). The mean attractiveness score (on a 5 points scale) for the female attractive face was 3.97 and 2.22 for the unattractive female face, 3.76 for the attractive male face, and 2.33 for the unattractive male face. There was no difference between the two attractive faces (male and female), nor between the two unattractive faces (see Appendix A1).

The incomes of the profiles took one of three different configurations: 3000¥ versus 12000¥ (large difference between the two profiles), 3000¥ versus 6000¥ (medium difference), and 5000¥ versus 6000¥ (small difference). Note that the average salary in the *parent* group was around 4600¥. The association between the picture and the income was randomized such that the income associated with the attractive face could be higher (*no trade-off*) or lower (*trade-off*) than the income associated with the unattractive face. We did not expect any difference between the three *no trade-off* conditions (attractive face associated with the higher income) but we also randomized the income profiles in the no trade-off context for the completeness of the experimental design.

The age and city of residency of the profiles were kept constant (27 years old, city of Kunming) and their role was only to make the profile appear more realistic. The position of the attractive face on the screen (top or bottom profile) was randomized. The profiles showed two men when the focus individual was a woman and two women when the focus individual was a man. Each participant only saw one pair and was asked to choose the hypothetical profile they would prefer for a long-term partner for the focus individual (i.e., for their son/daughter or for themselves according to the situation).

Procedure

The enumerators were students from the Yunnan Normal University who were trained by the research team. For data collection, the CAPI software Survey Solution from the World Bank was used on Android tablets. The World Bank also provided software support and server space that facilitated data collection. The enumerators went every Saturday between April and July 2016 to the marriage market at the Green Lake Park to recruit participants (with some exceptions for holidays and end-of-semester exams). For data collection at the YNNU campus, the university administration gave permission to open a stand in front of one of the two canteens. The canteens were frequented by most campus students which helped produce a more representative sample. Along with the hypothetical profiles choice, the survey included demographic information about the participant and focus individual (sex, age, income, household registration, education, religion, marital status, family size).

In an attempt to control for the biological value of the person to be married, we asked the participants to rate the focus individual's physical attractiveness: participants in the *parent* group had to rate their son or daughter's physical attractiveness, and participants in the *offspring* group had to rate their own physical attractiveness. The participants were asked to choose between the following answers: 'Not attractive', 'Not very attractive', 'Normal', 'Attractive', and 'Very attractive' (see Appendix A2 for the results).

The interviews were conducted in Mandarin Chinese but interviewers had knowledge of the local dialect. Small gifts of the value of 10¥ (2€) were provided to every participant who finished the interview.

Statistical analyses

We used an ordinal logit regression to analyse the participants' choice during the hypothetical profiles test. The response variable was the choice of the profile with the attractive face, which could take three different values: 1 (the participant chose the attractive face), −1 (the participant chose the unattractive face), and 0 (participant was indifferent: we added this option to avoid having participants choosing randomly if they had no preference for one of the profiles, and 14% of the participants chose this option, uniformly distributed across treatments). The results were substantively the same when omitting this last category from the analyses. Our variables of interest were the group: a parent looking for a spouse for his/her offspring (*parent* group) or a young individual looking for a partner for him or herself (*offspring* group); and the sex of the focus individual.

The experimental treatment was entered as an explanatory variable: the first three conditions corresponded to the cases where the attractive face was associated with a higher income than the unattractive face (*no trade-off* between physical attractiveness and income). The three other conditions corresponded to the cases involving a trade-off between physical attractiveness and income as the attractive face was associated with a lower income than the unattractive face. We differentiate between the different levels of trade-offs: a *small trade-off* condition (5000¥ vs. 6000¥), a *medium trade-off* condition (3000¥ vs. 6000¥), and a *large trade-off* condition (3000¥ vs. 12000¥). The experimental treatment variable was interacted with our two variables of interest: group and focus individual' sex. Control variables in the model were the focus individuals' age, income class (very low, low, medium or high), and education level (low, medium, or high).

The parent–offspring conflict theory does not necessarily imply that the strength of the conflict increases with the number of actual children (we could imagine a constant and

non-plastic psychological preference towards saving resources for any living or potential offspring). However, we cannot exclude the possibility that the number of actual offspring increases the parent–offspring conflict in the case of a trade-off. To test for this hypothesis, we added the focus individual's number of siblings as an interaction with the group and the experimental treatment (see model 1 in Table 1).

While we did not have enough data to control for the sex of the parent within our *parent* group, previous studies have found no or little difference between mothers' and fathers' preferences (Apostolou, 2007a; Apostolou & Wang, 2017; Dubbs & Buunk, 2010; Perilloux, Fleischman, & Buss, 2011; but see Dubbs *et al.*, 2013; Apostolou, 2015a; Wang & Apostolou, 2017). In our data set, mothers' and fathers' choices did not seem to differ (see Appendix A3).

For robustness, we run the same model without the control variables (see model 2 in Table 1), as well as within each group and for female and male focus individuals separately (see Table 2). The control variables which are non-significant in the first general model (model 1) were not included in the next models to preserve statistical power.

The ratings of the focus' physical attractiveness were recoded as a binary variable by regrouping the categories 'Not attractive', 'Not very attractive', and 'Normal' on the one hand, and the categories 'Attractive' and 'Very attractive' on the other hand. This variable was included as a control variable only in the models estimated within each group (Table 2), given the incomparability of self-rated attractiveness to parents' ratings of their offspring's attractiveness.

Moreover, to further understand the interaction effects in our model, we used the bootstrap sampling method with 1000 random re-samples with replacement (DiCiccio & Efron, 1996; Efron & Tibshirani, 1994). We calculated the mean differences between the predicted probability of choosing the attractive face and the predicted probability of choosing the unattractive face for each group, sex and treatment, and computed the 95% confidence interval of this estimate (for model 1, see Figure 2).

Results

The final *parent* group at the marriage market numbered 313 individuals (237 women, participants' mean age = 60.75 years old, range 37–80). The *offspring* group was comprised of 276 individuals (148 women, mean age = 23.11 years old, range 16–54). In our sample, 89% of our participants declared being atheists and 90% were from the Han ethnicity. Slightly more than half of the families were single-child (55%). Sixteen participants refused to give information about the focus individual's income, so the number of observations in the general model was 573.

As expected, there was no difference in the probability of choosing the attractive face between our three *no trade-off* conditions (cases where the attractive face was associated with a higher income than the unattractive face, all $p > .2$), confirming our hypothesis that it did not matter if the income of the attractive face was much higher, a bit higher, or moderately higher than the income of the unattractive face. In the following models, we grouped these three conditions under the label *no trade-off*.

The analysis of the participants' choices during the hypothetical profiles test showed that there was a significant and robust effect of the focus individuals' sex ($\beta = -1.94$, $p < .001$, see model 1 in Table 1 and Figure 2): individuals chose the profile with the attractive face more often when the focus individual was a man (i.e., people looking either for a wife or a daughter-in-law), supporting hypothesis H3.

Table 1. Results of the ordinal logit regression on the choice of the participants during the hypothetical profiles test. Model 1: results of the ordinal logit regression on the choice of the participants during the hypothetical profiles test ($N = 573$, as 16 participants refused to give information about their income and were excluded from this analyse). The response variable could take three different values: 1 if the participant chose the attractive face, −1 if the participant chose the unattractive face, and 0 if the participant was indifferent between the two profiles. Model 2: same model without the control variables ($N = 589$).

	Model 1 ($N = 573$)				Model 2 ($N = 589$)			
	Estimate	SE	*t* value	*p* value	Estimate	SE	*t* value	*p* value
Group								
Offspring	1.12	.54	2.08	.038*	1.23	.30	4.05	<.001***
Sex of focus								
Female (male faces)	−1.94	.40	−4.86	<.001***	−1.69	.35	−4.85	<.001***
Trade-off (Experimental condition)								
Small	0.19	.73	0.26	.793	0.08	.65	0.12	.906
Medium	0.45	.77	0.59	.557	0.01	.59	0.02	.985
Large	−0.17	.63	−0.27	.791	0.11	.54	0.20	.844
Age of focus	−0.05	.02	−2.16	.031*	–	–	–	–
Income of focus								
Low	0.60	.59	1.03	.304	–	–	–	–
Medium	0.56	.50	1.11	.267	–	–	–	–
High	−0.20	.52	−0.38	.706	–	–	–	–
Education of focus								
Medium	0.58	.86	0.68	.497	–	–	–	–
High	1.68	.80	2.11	.035*	–	–	–	–
Siblings of focus	−0.30	.33	−0.91	.363	–	–	–	–
Sex of focus*Trade-off								
Female*Small	0.13	.77	0.17	.863	0.45	.72	0.63	.526
Female*Medium	0.51	.68	0.75	.452	0.39	.62	0.63	.527
Female*Large	−0.53	.62	−0.85	.396	−0.58	.57	−1.02	.306
Group*Trade–off								
Offspring*Small	−0.82	.97	−0.84	.400	−0.18	.70	−0.26	.791
Offspring*Medium	−2.31	.80	−2.89	.004**	−1.21	.54	−2.23	.026*
Offspring*Large	−1.57	.68	−2.32	.020*	−1.47	.50	−2.93	.003**
Focus' number of siblings*Trade-off								
Siblings*Small	0.75	.82	0.92	.359	–	–	–	–
Siblings*Medium	0.02	.74	0.02	.984	–	–	–	–
Siblings*Large	1.40	.83	1.70	.089	–	–	–	–
Focus' number of siblings*Group								
Siblings*Offspring	0.11	.41	0.28	.782	–	–	–	–
Focus' number of siblings*Group*Trade-off								
Siblings*Offspring *Small	0.15	1.09	0.13	.893	–	–	–	–
Siblings*Offspring *Medium	0.52	.86	0.60	.550	–	–	–	–
Siblings*Offspring *Large	−1.12	.92	−1.21	.225	–	–	–	–
−1|0	−2.78	1.12	−2.49	.013*	−2.76	.33	−8.30	<.001***
0|1	−1.71	1.11	−1.54	.124	−1.72	.32	−5.40	<.001***

Notes. *$p < .05$; **$p < .01$; ***$p < .001$.

Table 2. Results of the ordinal logit regressions on the choice of the participants during the hypothetical profiles test, for female and male focus, and within each group (parents and offspring), respectively. The response variable could take three different values: 1 if the participant chose the attractive face, −1 if the participant chose the unattractive face, and 0 if the participant was indifferent between the two profiles.

	Female focus (male profiles, $N = 333$)				Male focus (female profiles, $N = 256$)				Parents ($N = 313$)				Offspring ($N = 273$)			
	Estimate	Std. Error	*t* value	*p* value	Estimate	Std. Error	*t* value	*p* value	Estimate	Std. Error	*t* value	*p* value	Estimate	Std. Error	*t* value	*p* value
Group																
Offspring	0.83	0.42	1.98	0.048*	0.71	0.73	0.97	0.333	–	–	–	–	–	–	–	–
Sex of focus																
Female (male profiles)	–	–	–	–	–	–	–	–	−1.67	0.42	−4.01	<0.001***	−1.76	0.67	−2.65	0.008**
Tradeoff																
Small	0.39	0.43	0.91	0.363	0.64	0.84	0.76	0.445	0.63	0.83	0.76	0.447	0.19	1.20	0.16	0.874
Medium	0.42	0.44	0.95	0.340	0.00	0.73	−0.01	0.995	−0.01	0.73	−0.01	0.993	−1.19	0.86	−1.38	0.167
Large	−0.56	0.37	−1.52	0.128	0.40	0.71	0.56	0.574	0.40	0.71	0.56	0.575	−1.57	0.78	−2.02	0.043*
Age of focus	−0.04	0.02	−1.63	0.104	−0.07	0.03	−2.10	0.036*	−0.07	0.03	−2.34	0.019*	−0.04	0.03	−1.45	0.148
Focus' attractiveness																
High	–	–	–	–	–	–	–	–	0.02	0.26	0.08	0.940	0.18	0.40	0.46	0.643
Group*Tradeoff																
Offspring*Small	0.40	0.92	0.44	0.658	−1.02	1.28	−0.80	0.423	–	–	–	–	–	–	–	–
Offspring*Medium	−1.23	0.63	−1.97	0.049*	−1.23	1.13	−1.08	0.279	–	–	–	–	–	–	–	–
Offspring*Large	−1.33	0.58	−2.29	0.022*	−1.98	1.06	−1.87	0.062	–	–	–	–	–	–	–	–
Sex*Tradeoff																
Female*Small	–	–	–	–	–	–	–	–	−0.29	0.94	−0.31	0.758	1.30	1.61	0.81	0.418
Female*Medium	–	–	–	–	–	–	–	–	0.40	0.85	0.47	0.637	0.28	0.98	0.28	0.777
Female*Large	–	–	–	–	–	–	–	–	−0.94	0.80	−1.17	0.244	−0.54	0.91	−0.60	0.550
−1|0	−2.34	0.79	−2.95	0.003**	−4.83	1.16	−4.15	<0.001***	−4.77	1.05	−4.54	<0.001***	−5.32	0.97	−5.49	<0.001***
0|1	−1.24	0.79	−1.59	0.113	−3.98	1.14	−3.48	<0.001***	−3.90	1.04	−3.76	<0.001***	−3.90	0.94	−4.15	<0.001***

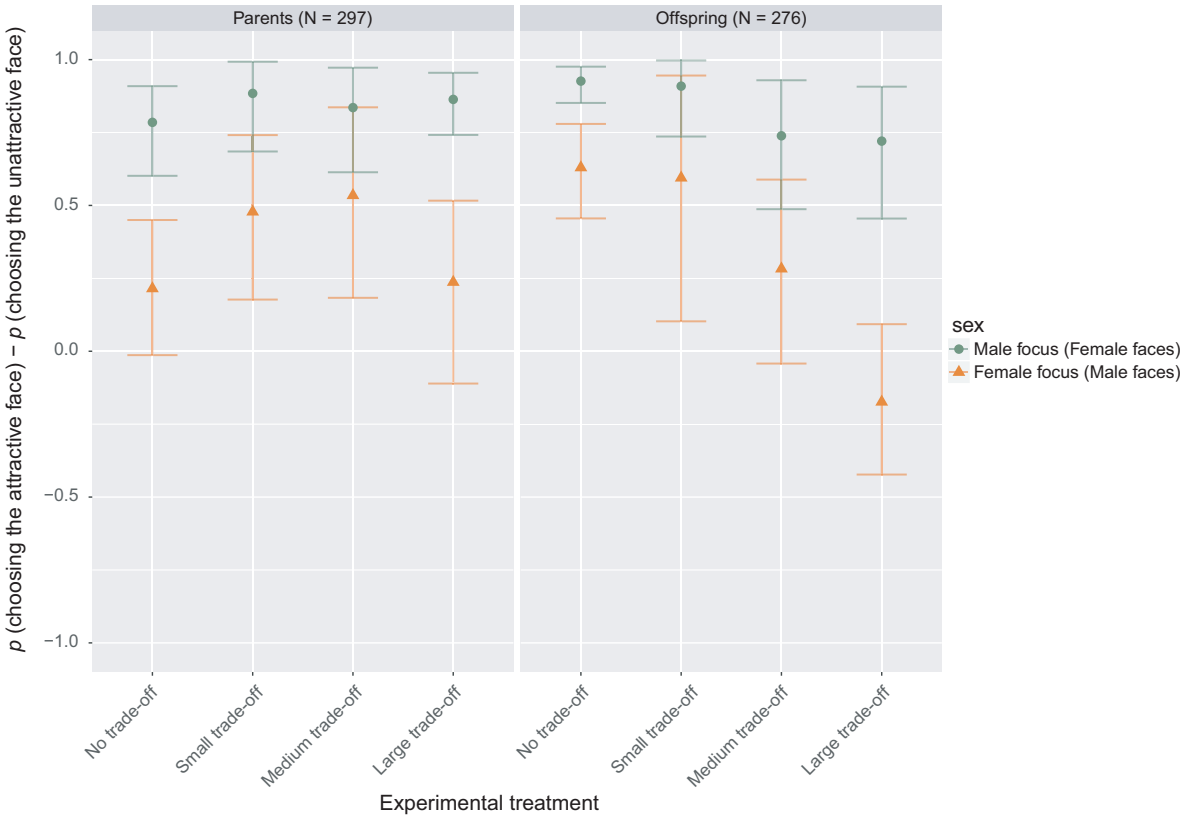

Figure 2. Bootstrap results of the mean differences between the predicted probability of choosing the attractive face and the predicted probability of choosing the unattractive face for model 1 (1000 random re-samples with replacement). Results are shown according to the group (parents on the left, offspring on the right), to the sex of the focus individual (green circles for male focus, orange triangles for female focus), and to the experimental condition (No trade-off: the attractive face is associated with the higher income; and small, medium, and large trade-off: the attractive face is associated with the lower income, with the respective pairs of income: 5000¥ vs. 6000¥; 3000¥ vs. 6000¥, and 3000¥ vs. 12000¥). Error bars show the 95% confidence intervals (when bootstrap confidence intervals do not overlap, the effect is considered significant).

As hypothesized, there was a difference between our two groups of participants ($\beta = -1.12, p = .038$, see model 1 in Table 1), but only for female focus individuals (see Figure 2 and Table 2): in the case of a male focus individual, parents and sons had the same strong preference for the female profile with the attractive face. However, daughters were more likely to choose the profile with the attractive face than the parents. Thus, we found some support for our main hypothesis (H1), but only in the case of daughters.

Surprisingly, this effect was in part driven by the *no trade-off* condition: parents were less likely to choose the attractive face associated with a higher income than their daughters (95% bootstrap CI = [−0.01, 0.45] for the parents, and [0.46, 0.78] for the daughters, see Figure 2). Note that when we created our experimental design, the no trade-off condition was mainly included as a control: we were expecting almost all participants to choose the attractive face when associated with the higher income. That is what we can see in the *offspring* group, where <5% of the participants chose the unattractive face under the *no trade-off* condition. However, 26% of the parents looking for a son-in-law chose the unattractive face associated with the lower income. Thus, the second hypothesis (H2) was not supported by our data: the parent–offspring conflict was not revealed in the case of a trade-off between income and facial attractiveness, but it was

revealed in the no trade-off conditions where a male profile with an attractive face was associated with a higher income than the profile with the unattractive face. We discuss this potential parental avoidance of the high-quality male profile in the discussion section.

The experimental conditions affected the probability of choosing the attractive face but only for the female offspring: in this group, participants were less likely to choose the profile with the attractive face when it was associated with a lower income than the unattractive face (95% bootstrap CIs: [0.46, 0.78], [0.10, 0.95], [−0.04, 0.59], and [−0.42, 0.09] for the *no trade-off*, *small, medium,* and *large trade-off* conditions, respectively, see Figure 2 and Table 2). Once again, there was no effect for the male focus individuals, as participants looking for a wife or a daughter-in-law were not influenced by the income, even in the case of a large income difference between the profiles (see Figure 2).

The focus individual's age had a small negative effect on the probability of choosing the profile with the attractive face ($\beta = -0.05$, $p = .031$, see model 1 in Table 1), and the probability of choosing the profile with the attractive face was higher for the group of focus individuals having a high education level ($\beta = 1.68$, $p = .035$, see model 1 in Table 1). There was no significant effect of the focus individual's income or number of siblings (all $p > .08$, see Table 1). The physical attractiveness of the focus individual had no significant effect on the probability of choosing the profile with the attractive face (all $p > .6$, see Table 2).

Our main effects hold when the control variables were removed from the model (see model 2 in Table 1), as well as when we run the model within each group and for male and female focus individuals separately (see Table 2).

Discussion

In this study, we experimentally investigated the parent–offspring conflict over mate choice in the case of a trade-off between investment potential (approximated by income) and biological quality (approximated by facial attractiveness). To do so, we interviewed parents and young individuals at the marriage market and a local university of Kunming, China. For our experiment, we used hypothetical profiles of young individuals similar to the actual profiles parents advertise at the marriage market. This allowed us to control the variables displayed in a naturalistic context where individuals were asked to choose between candidates, instead of rating a series of separate traits for a hypothetical scenario, as has generally been the case in previous studies. By having participants make a mutually exclusive mate choice that induces them to reveal their relative preferences for concrete levels of investment potential and biological qualities of hypothetical mates, we were able to test for potential threshold effects, something which an isolated rating on a trait would fail to capture. For example, resources (or income) of a potential mate could be rated as equally important by parents and offspring but what is considered as sufficient resources could differ significantly. We found some differences between parents' and offspring's preferences, moderated by the sex of the potential mate.

First, as hypothesized (H3) and in line with the results of previous studies, we found a sex difference, with people looking for a female partner (for themselves or for their offspring) valuing facial attractiveness more strongly, and even disregarding income, which is not the case for people looking for a male partner (Apostolou, 2007a, 2008, 2010a, 2016; Guo *et al.*, 2017; Perilloux *et al.*, 2011). Guo *et al.* (2017)'s study is of particular interest as it also takes place in China (but using different methods). They also found that traits linked to biological quality were more highly valued in a wife or a daughter-in-law than in a husband or son-in-law, while traits indicating investment

potential were more highly valued in a husband or son-in-law. This result can be explained by the different specializations with respect to reproduction: because of the high physiological costs of pregnancy and lactation, women's fitness is closely linked to their physical condition, making biological quality more crucial in a female mate than in a male mate (Buss, 1989b, 2003, 2015; Jones, 1996; Symons, 1980). Biological quality being reflected by physical appearance, this can explain why women's physical attractiveness is more decisive than men's during mate choice (see for instance Buss, 1989a; Buss & Schmitt, 1993; Li *et al.*, 2002; or Chang *et al.*, 2011 for an example in China).

The results of our study show that biological quality is also a crucial criterion for parents looking for a female partner for their male offspring. The consequence is the absence of an apparent conflict between parents and their sons even when there is a trade-off between physical attractiveness and income, as both prioritize the former over the latter. This result differs from studies showing that physical attractiveness is valued more in a wife than in a daughter-in-law (Apostolou, 2008, 2011, 2015b) which can be explained by the different populations studied, although the dissimilar experimental designs could be a more relevant explanation: individuals may declare that physical attractiveness for a daughter-in-law is not so important, but act differently when they see facial pictures. Moreover, results based on questionnaires could differ from our design which includes a clear trade-off with income: physical attractiveness may indeed be less important for parents than for sons, but still be more important than income for both parents and sons (because the minimal biological quality threshold is relatively high in a female mate). We conclude that the conflict between parents and sons may have been overestimated in previous studies using separate ratings of features instead of a single choice between different candidates with a clear trade-off.

The results differ with daughters. First, individuals looking for a husband are influenced by the level of income of the hypothetical profiles: a significant number of participants chose the profile with the unattractive face when it was associated with the higher income (*large trade-off* condition, see Figure 2). This is concordant with studies showing that the potential to attain resources is more important in a male than in a female mate and can once again be explained by the differences between males and females with respect to reproduction (Buss, 1989b, 2003, 2015; Jones, 1996; Li *et al.*, 2002; Symons, 1980). Second, we found some evidence of a conflict between parents and daughters, as parents were more likely than daughters to choose the male profile with the unattractive face. This is consistent with previous studies showing that physical attractiveness is rated as more important in a husband than in a son-in-law (Apostolou, 2008, 2011, 2015b). Hypothesis H1 was thus validated for daughters only.

Therefore, we found a conflict over mate choice between parents and daughters but not between parents and sons, which is similar to previous studies showing a greater conflict with daughters than with sons (Apostolou, 2012; Dubbs & Buunk, 2010; Dubbs *et al.*, 2013; but see Apostolou, 2015b). This result also fits the fact that parents are more likely to control the mating behaviour of their daughters than that of their sons (Apostolou, 2017; Perilloux, Fleischman, & Buss, 2008). Effectively, parents are less likely to worry about controlling the behaviour of their offspring if the opinions between parents' and offspring's do not differ.

As stated before, we also found some preliminary evidence of an interesting but unexpected result: a non-negligible number of parents seemed to avoid a male profile combining the attractive face with the higher income. This could in part be explained by the fact that older individuals rated the unattractive face as more attractive than did younger participants (see Appendix A1). However, this explanation is not sufficient as

the unattractive face is still rated as significantly less attractive than the attractive face by older individuals. Moreover, older individuals also rated more favourably the unattractive female face, but they almost never chose the unattractive female face ('avoidance' of the attractive face is only found for male faces). We suggest that this avoidance of the high-quality male profile could reflect an aversion to the risk of divorce (or break-up): a high-quality mate may have more opportunity to find a better mate and to leave their current spouse. The cost of divorce is considerably higher for women than for men (in particular in terms of re-mating opportunities) which could explain the sex difference. Parents with daughters could be more careful not to choose a too high-quality (and so risky) son-in-law to avoid the costs of having a divorced daughter (as they would have to invest more to compensate for the absence of the mate). A son-in-law who is both attractive and affluent might simply represent too high a potential cost for some parents. For daughters, this cost may be compensated by the benefits of having a mate with good genes/health/fertility transmitted to her children, which is less beneficial for her parents as they only share 50% of their genes (on average) with their daughter.

Some issues raised by our results need further study. First, for anonymity reasons, we were unable to contact the actual offspring of the parents coming to the marriage market in Kunming (to date, only a few studies on the parent–offspring conflict over mate choice have used parents and their actual children: Apostolou, 2015b, 2016; Guo *et al.*, 2017; Perilloux *et al.*, 2011). Instead, we interviewed young individuals looking for a mate for themselves (the majority being recruited at a university in the same city). Even if these individuals' preferences are probably similar, we cannot exclude the possibility that the results would have been different with the actual offspring of the parents. Parents might go to the marriage market when they have an offspring struggling to find a mate, which can be a sign of a lower mate value. Such offspring could be older, with lower education, poorer or less physically attractive. This is why in our model, we controlled for the focus individual's age, level of education, and level of income. We also asked the participant to rate the focus individual's physical attractiveness (see Appendix A2), and this variable had no effect on the participants' choices (see Table 2). In any case, differences between the two populations could hardly explain the results for the male participants where no difference was found between parents and offspring. Moreover, this limitation does not apply to our results within each group (such as the differences between daughters- and sons-in-law for example).

Further research with different stimuli is needed to further explore which dimensions of attractiveness influenced the participants and to vary other dimensions than facial attractiveness and income (e.g., faithfulness, cooperativeness, family background). A possibility could be to add a description of some personality traits, which however would deviate from the actual profiles displayed at the marriage market.

One potential issue linked to our sample in particular is the Chinese family planning policy. Parent–offspring conflict theory implies that parents have incentive to reduce the investment in one child to be able to invest in other offspring. One can ask if the one-child policy, introduced in 1979 (and replaced by a two-child policy in 2015), would make the parent–offspring conflict concept irrelevant in this population. We argue that it is most likely not the case. First, we do not know if the parent–offspring conflict selected for preferences plastic to environmental conditions or for more deeply rooted preferences unlikely to be affected by a policy implemented only a few decades ago. Moreover, the one-child policy was not applied to the entire population and exemptions existed (Baochang, Feng, Zhigang, & Erli, 2007). More importantly, couples under the one-child policy could still decide to have an additional child, but with a cost (fines and penalties, see Scharping, 2013) which makes the parent–offspring conflict even stronger as the

investment in another child is increased. Finally, in our sample, 45% of the focus individuals had at least one sibling and the number of siblings did not have any effect on our results. Because of the one-child policy, we were also expecting a biased sex ratio among young individuals. Indeed, since the early 1980s, China's sex ratio at birth has been significantly above normal levels (Poston & Glover, 2005). However, we found no sign of this unbalanced sex ratio in our sample, as 56% of our focus individuals were women. This may be because it was an urban sample, less affected by the unbalanced sex ratio than rural areas (Yi *et al.*, 1993). Therefore, we are reasonably confident that our results are not driven by a biased sample.

Conclusion

This study addressed limitations of previous research into parent–offspring conflict over mate choice using a novel design and a unique sample. An experimental approach was used in a naturalistic context with a strong parental influence: a Chinese marriage market where parents come weekly to actively search for a marital partner for their adult children. Our experiment was designed to specifically include a key condition of the parent–offspring conflict over mate choice theory: the presence of a trade-off between biological quality and investment potential. Participants had to choose between two profiles of hypothetical candidates, representing conditions closer to reality than a survey where participants rate a list of features.

Our results replicated those of previous studies and opened several interesting future directions. As predicted by an evolutionary perspective, we found a sex difference with individuals valuing physical attractiveness more in a wife or a daughter-in-law than in a husband or a son-in-law. A conflict between parents and daughters was revealed with daughters valuing physical attractiveness more than parents looking for a son-in-law. Interestingly and contrary to previous studies, no conflict between parents and sons was found even in the case of a trade-off between facial attractiveness and income, as cues of biological quality were always considered as more important than investment potential in a female partner. Finally, a noteworthy but unexpected result appears, as some parents avoided the high-quality male profile, maybe reflecting an aversion to the risk of divorce for their daughters.

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Data Availability

Data and reproducible analysis code are available at http://dx.doi.org/10.17632/87sccr2n7g.1

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Appendix

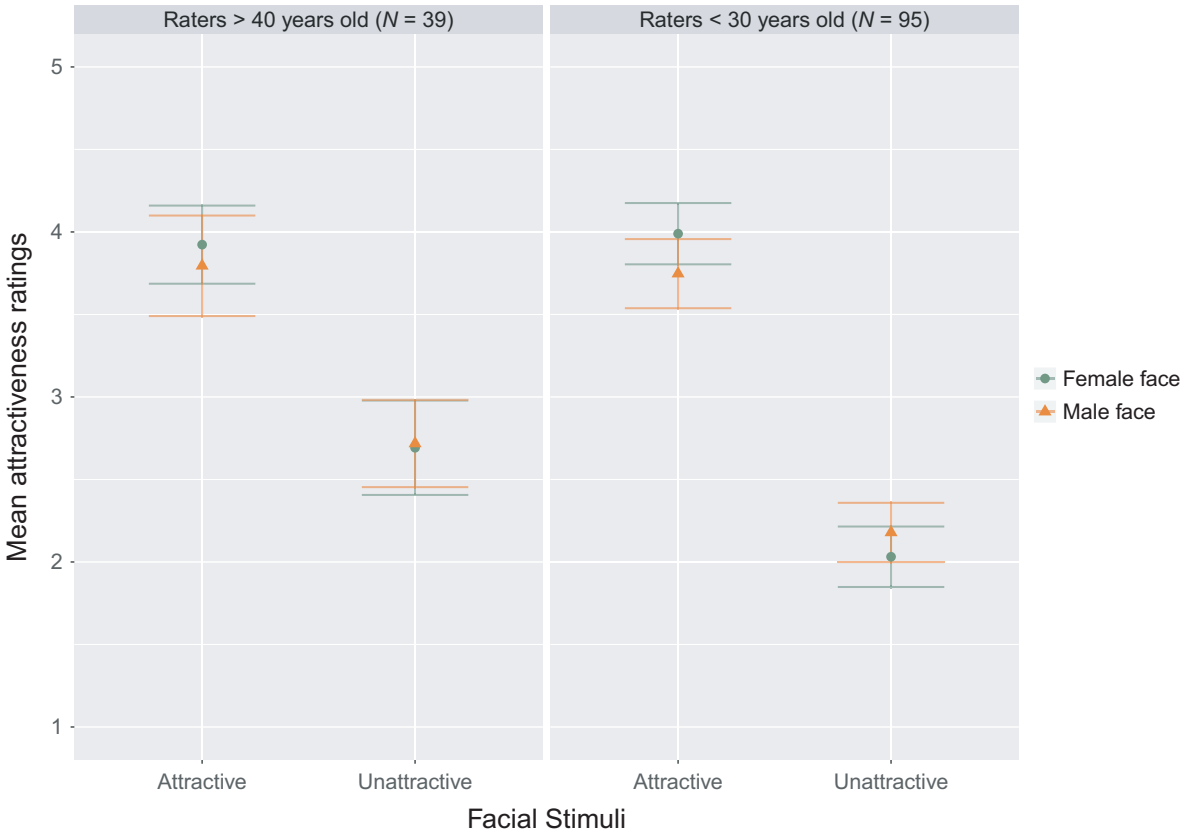

Figure A1. Attractiveness ratings (from 1 to 5) for the four faces from two different age groups of participants: The first (left panel) is constituted of people older than 40 years old (N = 39, mean age = 62, range: 41–70 years old). The second group (right panel) includes individuals under 30 years old (N = 95, mean age = 21, range: 18–27 years old). During this test, participants had to rate the physical attractiveness of the four faces used in the hypothetical profiles test, without any other information added to the pictures. The pictures were randomly presented. The young individuals were students at the YNUU. The older individuals were parents and relatives of the students. These participants were not part of the general survey and were unaware of the hypotheses of the study. There were significant differences in attractiveness rating between attractive and unattractive faces for both sexes, and for both groups of raters (two-tailed t-test, all $p < .001$). There were also significant differences between the two groups, but for the unattractive faces only: compared to younger raters, older raters gave higher attractiveness ratings to both female ($p < .001$) and male ($p = .001$) unattractive faces. There was no difference between the two attractive faces (male and female), nor between the two unattractive faces ($p > .08$ in both groups). Error bars show the 95% confidence intervals.

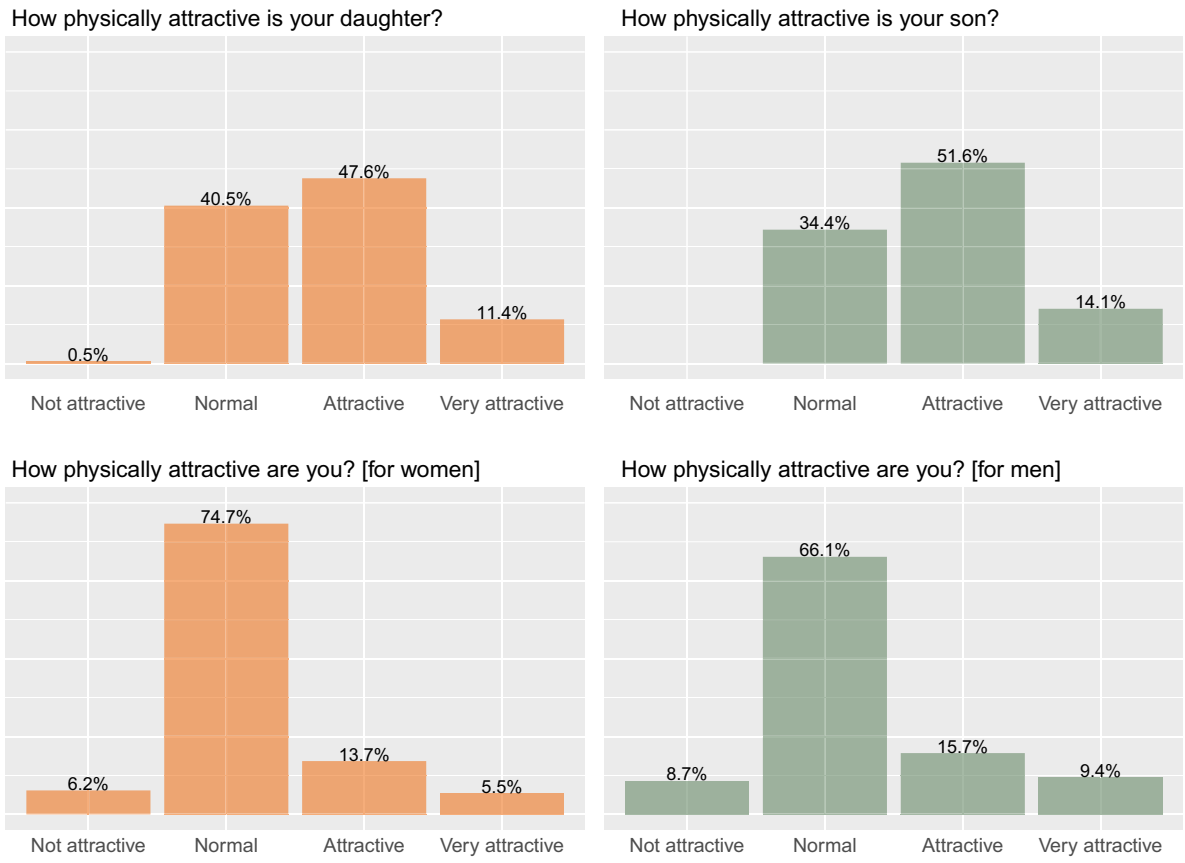

Figure A2. Participants' ratings of the focus individuals' physical attractiveness. Participants in the *parents* group were asked to rate their offspring's physical attractiveness, and participants from the *offspring* group were asked to rate their own physical attractiveness. The participants had to choose between 'Not attractive', 'Not very attractive', 'Normal', 'Attractive', and 'Very attractive'. Because very few participants chose the answers 'Not attractive' and 'Not very attractive', these two categories were merged for the figure. Top: answers from the *parents* group. Bottom: answers from the *offspring* group. Left/orange: female focus individuals. Right/green: male focus individuals.

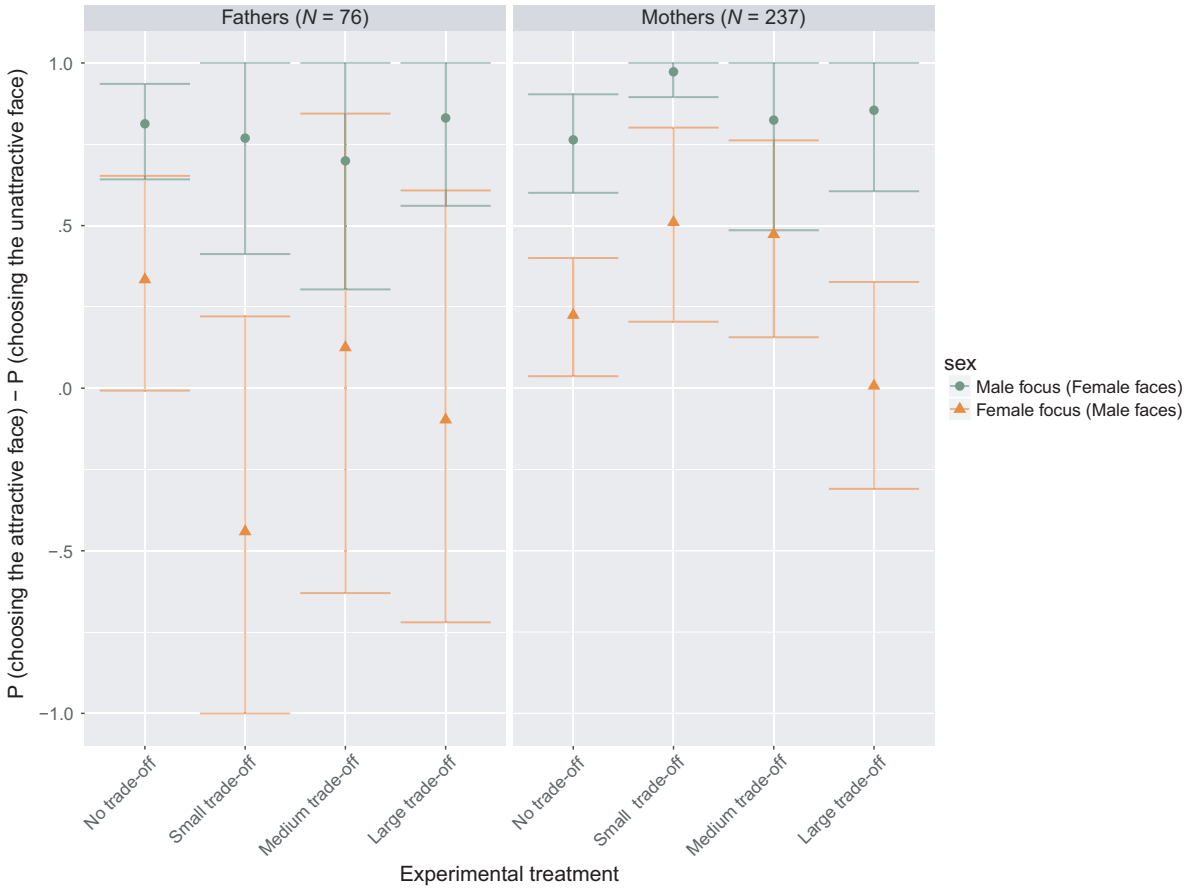

Figure A3. Bootstrap results of the mean differences between the predicted probability of choosing the attractive face and the predicted probability of choosing the unattractive face (1000 random re-samples with replacement). Results are shown only for the *parents* group, according to the sex of the participant (fathers on the left, mothers on the right), to the sex of the focus individual (circles for male focus, triangles for female focus), and to the experimental condition (No trade-off: the attractive face is associated with the higher income; and small, medium and large trade-off: the attractive face is associated with the lower income, with the respective pairs of income: 5000¥ vs. 6000¥; 3000¥ vs. 6000¥, and 3000¥ vs. 12000¥). Error bars show the 95% confidence intervals.