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Arranged marriage in evolutionary perspective: Implications for the uniqueness of human mating systems

A dissertation submitted in partial satisfaction of the
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in Anthropology

by

Elizabeth R. Agey

Committee in charge:

Professor Steven J.C. Gaulin, Chair

Professor Daniel Conroy-Beam

Professor Michael Gurven

Professor David W. Lawson

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The dissertation of Elizabeth R. Agey is approved.

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Daniel Conroy-Beam

_____

Michael Gurven

_____

David W. Lawson

_____

Steven J.C. Gaulin, Committee Chair

September 2023

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Elizabeth Agey

EDUCATION

PhD Anthropology
University of California, Santa Barbara 2023
Santa Barbara, CA
Advisor: Steven Gaulin

MA Anthropology
University of California, Santa Barbara 2019
Santa Barbara, CA

BA Anthropology
University of Northern Iowa
Cedar Falls, IA 2015

RESEARCH

Publications

Agey, E., Crippen, S., Wells, A., and Upreti, P. (2023). Socioeconomic benefits and limited parent- offspring disagreement in arranged marriages in Nepal. *Evolutionary Human Sciences, 5,* E7. DOI: https://doi.org/10.1017/ehs.2023.3

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TEACHING

University of California, Santa Barbara

2023	Instructor, Evolutionary Psychology
2022	Instructor, Introduction to Biological Anthropology
2016-2022	Lead Teaching Assistant, Introduction to Biological Anthropology
2022	Teaching Assistant, Evolutionary Psychology
2020	Teaching Assistant, Evolutionary Medicine
2017	Teaching Assistant, Introduction to Biosocial Anthropology
2015-2016	Teaching Assistant, Introduction to Biological Anthropology

MENTORING

Present	Sigal Plotkin, University of California Santa Barbara, Class of 2025
2019-2020	Savannah Crippen, University of California Santa Barbara, Class of 2021
2018-2020	Alyx Wells, University of California Santa Barbara, Class of 2020
2018-2020	Julia Weber, University of California Santa Barbara, Class of 2020
2016-2018	Maya Chandy, University of California Santa Barbara, Class of 2019
2016-2018	Addison Morris, University of California Santa Barbara, Class of 2019

FUNDING

2019	National Science Foundation Cultural Anthropology Doctoral Dissertation Research Improvement Grant	$20,000
2019	Charles J. Erasmus Award, UCSB Department of Anthropology	$1,175
2018	Broom Center for Demography Graduate Student Research and Travel Grant	$1,000
2018	Graduate Division Humanities and Social Science Research Grant	$3,000
2017	Broom Center for Demography Graduate Student Research and Travel Grant	$2,000
2016	Charles J. Erasmus Fund, UCSB Department of Anthropology	$1,000
2016	Broom Center for Demography Graduate Student Research and Travel Grant	$2,000

Abstract

Arranged marriage in evolutionary perspective: Implications for the uniqueness of human mating systems

by

Elizabeth R. Agey

Many people have strong opinions about the kind of person they want to mate with or marry, and we spend a lot of time evaluating potential partners for the qualities they have. These time-consuming tasks likely have an evolutionary function—they steer us toward mates that have qualities that will increase our reproductive success. While this assumption has been experimentally tested in animals, the same experimental methods are not possible in humans. Instead, we have to rely on existing cultural systems where there is variation in the amount of independent mate choice individuals get to exercise. One such case is arranged marriages, an ethnographically common system in which parents are deeply involved in choosing a partner for their offspring, sometimes with little input from the marrying individuals. Evidence indicates that parents arranging a marriage are not evaluating sons- or daughters-in-law based on the same qualities that offspring would use to find a match on their own. Therefore, individuals in arranged marriages, who are not expressing their evolved mate preferences, should have reduced reproductive success. This dissertation tests this prediction using data from the Chitwan Valley Family Study (Axinn et al., 2023). These analyses show that there are no differences in total births, offspring survival, or interbirth intervals between individuals in arranged and non-arranged marriages, which is not in line with predictions. To investigate why arranged and non-arranged marriages have similar reproductive outcomes, I

then examine the alternative benefits provided by arranged marriages in Dhading, Nepal, demonstrating that arranged marriages offer substantial social and financial incentives. I then examine divergence between the in-law/partner preferences of parents and offspring in Dhading, identifying significant disagreement over several traits, including physical attractiveness and caste identity. Together, these results indicate that, while individuals in arranged marriages may miss out on fitness benefits gained by independent mate choice, the alternative social and financial benefits of arranged marriage may compensate for those losses. Thus, individuals in arranged and non-arranged marriages may be obtaining similar reproductive outcomes via alternative pathways. These results highlight the role of kin and social support in human mating systems, which is likely unique among animals.

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Chapter 1: Introduction: Mate Choice and Arranged Marriage

Authored by:

Elizabeth Agey

1.A. Introduction

The three features of sexual reproduction are meiosis, recombination, and outcrossing. There are no behavioral choices to be made with respect to the first two processes, but the third offers huge scope for the evolution of adaptive strategies. In that regard, many sexually reproducing species have strong preferences when it comes to choosing reproductive partners. Because mating selectively is more costly than just mating with the first available option, such preferences must have been adaptive. While there are thousands of studies of particular mate preferences in humans and other animals, there are surprisingly few that attempt to test whether expressing these mate preferences increases fitness.

In other animals, randomized experiments can illuminate clear relationships between free-choice mating and increased fitness, but similar experiments are not feasible for humans. Thus, to test the assumption that human mate preferences evolved to target fitness-enhancing qualities, it is necessary to find an existing cultural system where individuals vary on the degree of choice over their mate. One such system found in many geographic regions is arranged marriage.

Arranged marriages are cases in which parents (or sometimes other kin) primarily choose mates for their children, sometimes with no input from the members of the marrying couple (Shenk, 2017). Existing surveys suggest that parents and offspring do not express identical preferences for an in-law/spouse, respectively (Apostolou, 2011b, 2015; Bovet, Raiber, Ren, Wang, & Seabright, 2018; Buunk, Park, & Dubbs, 2008; Perilloux, Fleischman, & Buss, 2011); thus, spouses chosen by parents and spouses chosen by offspring may possess different qualities. If individual mate preferences evolved to increase fitness, as is presumed

in much of the evolutionary mate choice literature, then in cases where individuals do not choose their own mates, fitness may be lower compared to couples who have independently chosen their reproductive partners. Throughout this dissertation, I will refer to this prediction as mate-choice theory. This dissertation will establish several beachheads in the evolutionary investigation of arranged marriage.

First, I will use cross-cultural comparison to establish that parents and offspring often prefer different individuals as an in-law versus a spouse. Second, I will investigate whether women in arranged marriages or non-arranged marriages have more total births, higher offspring survival, or shorter interbirth intervals using data from the Chitwan Valley Family Study (CVFS) (Axinn et al., 2022). Third, I will assess data from focus group discussions in Dhading, Nepal to understand the ways in which marriages are formed, the scope for parents and offspring to prefer different individuals in those marriages, and the potential for arranged marriages to offer compensatory fitness-relevant benefits. Last, I will quantitatively investigate the degree and domains of parent-offspring disagreement over the ideal qualities of a spouse in Dhading, Nepal. Overall, these chapters will demonstrate that parents and offspring do not agree over the qualities in a potential spouse in Nepal and cross-culturally (Chapters 2 and 5), yet reproductive outcomes do not seem to differ based on mode of spouse choice (Chapter 3). This could be because for some reason, human mating preferences do not increase reproductive success and/or because arranged marriages offer many benefits to couples than can compensate for not choosing a spouse independently (Chapter 4).

1.B. The fitness benefits of mate choice in non-human animals

If mate preferences do not steer individuals toward mates who will increase their and their offspring's reproductive success these preferences should not have evolved. A body of 34 studies, summarized in Table 1.1, experimentally test whether free mate choice increases fitness in non-human animals. There are two principal experimental designs which have been applied to a number of taxa, including insects, mice, fish, birds, and large mammals. The first design places an individual either in a setting with multiple potential mates to choose from (free mate choice) or with a single mate chosen at random by the experimenter (limited mate choice). The second design assesses an individual's mate preference, and then mates that individual either with their preferred (free mate choice) or non-preferred mate (limited mate choice). These designs assess choice/preference from the perspective of females (n=26), males (n=7), or mutual preference by both sexes (n=8). 82% of these studies show at least one benefit to free choice mating. Most studies examine a large number of fitness outcomes, including number of offspring, offspring viability, offspring growth rates, resistance to infection, dominance, and ecological success. Many of these studies examine these outcomes at multiple stages of development (e.g., they measure rates of survival at 3 or 4 life stages), and thus they test a large number of fitness outcomes. Across these studies, 33% of the 438 outcomes tested show a benefit to free mate choice, 4% show a benefit to limited mate choice, and 63% are null results. From the available studies, free mate choice produces fitness benefits more often than limited mate choice.

The benefits of free mate choice are seen most consistently in certain fitness domains. The most common fitness benefits for free mate choice are offspring viability (Agbali, Reichard, Bryjová, Bryja, & Smith, 2010; Anderson, Kim, & Gowaty, 2007; C. Bluhm &

Gowaty, 2004; Crocker & Day, 1987; Ihle, Kempenaers, & Forstmeier, 2015; Massa, Galanti, & Bottoni, 1996; Partridge, 1980; Sun, Zhou, Stone, Qiu-Hong, & Sheng-Guo, 2019; Wu, Wen, Chen, Li, & Jiao, 2018), faster reproductive rate (Drickamer, Gowaty, & Wagner, 2003; Gleason, Holschbach, & Marler, 2012; Hartnett, Parrott, Mulder, Coulson, & Magrath, 2018; Simmons, 1987), and improved offspring growth (Drickamer et al., 2003; Havens, Orzack, & Etges, 2011; Lahaye et al., 2015; Sandvik, Rosenqvist, & Berglund, 2000; Simmons, 1987; Wu et al., 2018). In some cases offspring of free choice matings also display greater resistance to infection (Raveh et al., 2014), higher dominance, or more successful behavioral strategies (Drickamer et al., 2003). The effect of free mate choice on number of offspring produced is unclear; some studies show no difference in number of offspring (Drickamer et al., 2003) or higher number of offspring in limited-choice matings (Anderson et al., 2007; Moore, Gowaty, Wallin, & Moore, 2001; Swierk & Langkilde, 2019). This could be due to reproductive compensation, whereby individuals produce more offspring when paired with suboptimal mates in order to compensate for poorer quality offspring (Gowaty et al., 2007). Because the clearest benefits to free mate choice in experimental studies are seen in survival, reproductive rate, and offspring growth, these are the logical fitness outcomes to examine in humans as well.

Table 1.1: List of experimental studies testing the effects of free mate choice on fitness outcomes in non-human animals

Paper	Species	Focal Sex	N tested	N benefit to choice	N benefit to no choice	N no effect
Agbali et al., 2010	*Rhodeus ocellatus*	F	29	7	0	22
Anderson et al., 2007	*Drosophila pseudoobscura*	F	4	2	1	1
		M	4	3	0	1
		B	6	2	0	4

Bertram et al., 2016	*Gryllus assimilis*	F	6	0	0	6
Bertram et al., 2017	*Gryllus assimilis*	M	15	0	0	15
Bluhm & Gowaty, 2004	*Anas platyrhynchos*	F	19	5	0	14
Bottoni, Massa, Lea, & Sharp, 1993	*Alectoris rufa*	B	15	9	0	6
Crocker & Day, 1987	*Coelopa frigida*	F	8	4	0	4
Drickamer, Gowaty, & Holmes, 2000	*Mus musculus*	F	26	8	1	17
Drickamer et al., 2003	*Mus domesticus*	B	20	10	0	10
Edward & Chapman, 2012	*Dosophila melanogaster*	M	10	1	0	9
Forsgren, 1997	*Pomatoschistus minutus*	F	3	2	0	1
Gleason et al., 2012	*Peromyscus californicus*	F	2	2	0	0
Gowaty, Drickamer, & Schmid-Holmes, 2003	*Mus domesticus*	M	31	6	2	23
Hartnett, Parrott, Mulder, Coulson, & Magrath, 2018	*Perameles gunnii*	F	3	2	0	1
Havens et al., 2011	*Drosophila mojavensis*	B	29	13	0	16
Ihle et al., 2015	*Taeniopygia guttata*	F	30	8	1	21
Janhunen, Kekäläinen, Kortet, Hyvärinen, & Piironen, 2011	*Salvelinus alpinus*	F	1	0	0	1

Lahaye et al., 2015	*Melopsittacus undualtus*	F	31	9	0	22
Lehtonen & Lindström, 2007	*Pomatoschistus minutus*	F	11	2	0	9
Martin & Shepherdson, 2012	*Brachylagus idahoensis*	F	8	2	0	6
Martin-Wintle et al., 2015	*Ailuropoda melanoleuca*	F	4	2	1	1
		M	4	3	0	1
		B	4	2	0	2
Massa et al., 1996	*Melopsittacus undulatus*	B	7	6	1	0
Moore et al., 2001	*Nauphoeta cinerea*	F	10	0	1	9
Nicoletto, 1995	*Poecilia reticulata*	F	22	7	0	15
Oneal, Connallon, & Knowles, 2007	*Drosophila mojavensis*	F	1	1	0	0
Parrott, Nation, & Selwood, 2019	*Sminthopsis macroura*	F	6	3	0	3
Partridge, 1980	*Drosophila melanogaster*	F	3	3	0	0
Pogány, Szurovecz, Vincze, Barta, & Szekely, 2014	*Taeniopygia guttata*	F	6	0	0	6
Raveh et al., 2014	*Mus musculus*	F	12	4	0	8
Sandvik et al., 2000	*Syngnathus typhle*	F	3	0	2	1
		M	3	0	0	3
		B	6	3	0	3
Simmons, 1987	*Gryllus bimaculatus*	F	9	4	0	5
Sun et al., 2019	*Nipponia nippon*	B	6	6	0	0

Swierk & Langkilde, 2019	*Rana sylvatica*	M	10	0	6	4
Wu, Wen, Chen, Li, & Jiao, 2018	*Pardosa astrigera*	F	11	4	0	7
TOTAL			438	145 (33%)	16 (4%)	277 (63%)

Focal sex is coded as: F=Female Choice, M=Male Choice, B=Both males and females mutually preferred or dispreferred each other. Results for the effects of female, male, and mutual mate choice within the same paper are in separate rows accordingly.

1.C. Arranged marriage as a proxy for limited mate choice

The experimental nature of the animal studies described above, allows the possible fitness benefits of free mate choice to be directly assessed. Because replicating these designs in humans is impossible, the only way to examine whether mate choice has similar fitness consequences in our own species is to identify naturally occurring situations where some people choose their mates while others do not. Thus arranged marriages, where parents (and other kin) are primarily responsible for choosing a spouse for their offspring, may offer one class of situations that provide a partial proxy for the experimental animal studies discussed above. Because parents and offspring share (only) 50% of their genes, their fitness interests do not perfectly align (Trivers, 1974). If parents and their children prefer and actually choose different individuals as an in-law/spouse, respectively, then evolved mate preferences are at least partially thwarted, provided that parental and offspring preferences serve their respective fitness interests. Where variation in spouse choice exists, especially within the same community, then variation in fitness effects may be discernable.

However, some key differences between arranged marriages and the experimental designs (Table 1.1) should be noted. Mate choice, by either the parent or offspring, occurs in both arranged and non-arranged marriages, so there is no randomized mating condition as there is in experimental animal studies. Additionally, the types of individuals who enter

different types of marriages may be systematically different. For example, parents with large amounts of inheritable wealth may have added leverage over their offspring's spouse choice compared to families with very little inherited wealth. These demographic differences amount to non-random assignment and could affect fitness outcomes. Therefore, it will be important to consider other demographic and societal factors when considering arranged marriage as a proxy for limited mate choice.

1.D. Ethnographic context of arranged marriage

Arranged marriages are ethnographically widespread (Broude & Greene, 1983). In 96% of hunter-gatherer groups, parents play a significant role in choosing marriage partners for their children (Apostolou, 2007). Based on ancestral-state reconstruction, arranged marriages may have been common at least since *Homo sapiens sapiens* left Africa (Walker, Hill, Flinn, & Ellsworth, 2011). There is a range of degrees of parental influence in arranged marriages—such pairings could be completely arranged by parents with no offspring input or parents could seek offspring approval for their choice prior to arrangement (Shenk, 2017). In non-arranged marriages, in which offspring choose their own partner, parents may still play a critical role of approving the offspring's selection. Even in industrialized western contexts, parents provide valuable input into their offspring's partner choice (Sprecher & Felmlee, 1992; Sussman, 1953). Thus, arranged marriage is best thought of as a spectrum of parental influence over offspring mate choice decisions, rather than a discrete category of marriages.

While the scope of parental influence over spouse choice is broad, it shows some systematic variation. Arranged marriages are more common for women than for men in the Standard Cross-Cultural Sample (Broude & Greene, 1983). Parents in agropastoral and

historical societies likewise exert more control over their daughters' marriages than their sons' marriages (Apostolou, 2010b, 2012). Thus, in some marriages men chose their mate individually and negotiated the marriage with the parents of their potential wife. While arranged marriages exist in all subsistence types, parents can hold greater decision making power over their offspring's spouse choice in contexts where wealth is inherited, such as agricultural or pastoral societies (Apostolou, 2010b). In these contexts, children may also prefer arranged marriages if they have much to lose (financially) from non-arranged marriage.

In the ethnographic literature the distinction between arranged and non-arranged marriage can be ambiguous. Arranged marriages are often contrasted with "love marriages" (marriages where the couple meets, falls in love, and marries with little parental input). However, feelings of love before or after marriage can be independent of who selected the spouse. Thus, for this dissertation, arranged marriages will generally refer to marriages in which parents initially find a spouse for their offspring. Marriages in which offspring initially found the person they married will be referred to as non-arranged marriages. Arranged marriages and non-arranged marriages may be further subdivided in individual chapters based on available data. However, this dissertation will demonstrate that categorization of arranged vs. non-arranged marriage is complex and multi-faceted.

1.E. Parent-Offspring Conflict Over Mate Choice

Arranged marriages should affect fitness only if parents and offspring would select different individuals as an in-law/spouse, respectively. Parent and offspring interests are not predicted to perfectly align because parents are related to each of their offspring by only one-

half; thus parents weigh the fitness prospects of each offspring equally, whereas each offspring values its own fitness prospects twice as much as it values the fitness prospects of any full sibling (and four times as much as it values the fitness prospects of half siblings) (Trivers, 1974). From the offspring's perspective, they can maximize their fitness through their own reproduction rather than through the reproduction of their siblings. This produces an asymmetry of interests between parents and offspring, who have differing optima concerning the allocation of parental investment.

Thus, when it comes to marriage, parents may try to arrange matches that can benefit all of their offspring in addition to the currently marrying offspring. For example, arranging marriages that increase access to trade, alliances, or status can benefit all members of the family (Trivers, 1974). These social opportunities may be signaled by the background of the potential spouse's family or by markers of similar ethnic/cultural group (Apostolou, 2008b). From the perspective of any individual offspring, however, selection should have molded preferences and inclinations that maximize personal fitness. Thus, offspring may place more weight on traits like physical attractiveness, a presumed sign of genetic quality (Thornhill & Gangestad, 1999), as physical attractiveness provides greater fitness benefits to the offspring than to their parents (Apostolou, 2008a). Because some aspects of physical attractiveness, could be specific to the genetic profile of the choosing individual, parents may be unable to choose mates for their offspring that optimize the genetic benefits of mate choice, further incentivizing disagreement over this trait. One such trait that parents would hypothetically be ill-equipped to assess on behalf of their offspring is cues of MHC dissimilarity, although evidence for the role of these cues in mating decisions is still unclear (see Havlíček, Winternitz, & Roberts, 2020; Winternitz, Abbate, Huchard, Havlicek, & Garamszegi, 2017).

Surveys seem to align with the above predictions about divergent parent and offspring preferences. Across several studies, offspring report greater preferences for physical attractiveness in a spouse than do their parents, including in arranged marriage contexts (Apostolou, 2011b; Fugère, Doucette, Chabot, & Cousins, 2017; Guo, Li, & Yu, 2017; Lefevre & Saxton, 2017; Perilloux et al., 2011). These studies also find that parents place more value on signs of in-group membership, such as similar caste, ethnicity, or religion, than do offspring. Parents also more highly value the social capital of the potential spouse's family than do their offspring (Apostolou, 2008b, 2011a). Another study also showed that parents prefer in-laws who directly display willingness to cooperate with the in-group (Tirnanic, 2011). However, parent-offspring differences in preference for status or in-group membership is not found in all contexts, including some studies in cultures with a tradition of arranged marriages (Bovet et al., 2018). Overall, parent-offspring disagreement is more pronounced for daughters and their parents than sons and their parents (Bovet et al., 2018; Dubbs, Buunk, & Taniguchi, 2013), indicating that daughters may be less likely than sons to have their preferences met in arranged marriages.

1.E.i. Parent and offspring strategies to "win" in a disagreement

Parents may use tactics to convince offspring to agree to an arranged marriage, and these tactics can vary in severity (Apostolou, 2013). Parents may arrange a marriage at younger ages, when offspring have less bargaining power to oppose an undesirable arrangement. Parents may threaten to withhold social or financial resources including access to alliances, trade, or social prestige from offspring who marry independently. For example, in the Ju'/hoansi, couples in arranged marriages have larger trade networks than non-

arranged couples in the same communities (Wiessner, 2009). In societies with material wealth, parents may also reduce or refuse to give an inheritance for offspring who do not accept an arranged marriage. Parents may also deny marriage payments, like bridewealth or dowry, in societies where these practices are critical to marriage. Parents could also reduce grandparental investment in offspring from non-arranged marriages. Because grandparents (especially maternal grandparents) can make a significant difference to child survival (Sear & Mace, 2008), threatening a lack of grandparental care could persuade reluctant offspring. These types of parental tactics could consist of direct threats (e.g., "If you don't marry this person, I won't give you an inheritance") or they could be understood as potential consequences without direct communication (e.g., someone in the community was denied an inheritance after refusing an arranged marriage, so an offspring anticipates they would receive the same consequence). These tactics tangibly display the costs and benefits to different modes of spouse choice, and offspring may logically choose to agree to arranged marriages if the cost of losing these social or financial resources is higher than the cost of forgoing mate choice. Chapter 2 further describes several parental threats and sanctions associated with parent-offspring disagreement over arranged marriages using cross-cultural ethnographic data.

On the other hand, offspring also have tactics to achieve their preferred mating outcome (Apostolou, 2017). Offspring could run away with a mate they prefer, typically referred to as an elopement. They can also engage in premarital sex (sometimes resulting in pregnancies) to force parents agree to their partner choice. This strategy would be particularly effective for women and in societies with strict rules about premarital sex. Even if offspring do not get to marry the person they choose, they sometimes use strategies to

obtain better mates outside of marriage. In societies where divorce is allowed and common, individuals may divorce an arranged match and remarry someone they prefer. In societies where divorce is not allowed, extrapair matings may allow individuals to obtain more optimal mates. For example, in the Himba, where extrapair copulation is acceptable, all cases of extrapair paternity resulted from women who were in arranged marriages (Scelza, 2011). Chapter 2 will detail several of these offspring strategies in cultures with arranged marriages.

1.E.ii. What might parent-offspring agreement look like?

While surveys show some scope for disagreement, there is also much agreement between parents and offspring. Traits like kindness, good character, and intelligence are often rated as important by both parents and offspring (Apostolou, 2011a; Perilloux et al., 2011). Ambition and liking children are also desirable to parents and offspring alike (Fugère et al., 2017). Chapter 3 will describe high parent-offspring agreement over qualities like education, good income, and marriage timing in the CVFS. Likewise, Chapter 4 demonstrates stated agreement over qualities like caste and family background elsewhere in Nepal, despite these being qualities that show disagreement in previous surveys. Offspring also seem to desire a spouse who would be acceptable to their parents (Apostolou, 2009). This may mean that while parents and offspring disagree over stated ideals, they often end up selecting spouses that are mutually preferred. Thus, disagreement between parents and offspring may only result when one party selects an individual who does not meet the other's minimum acceptable value (i.e., a threshold) on some trait. Chapter 5 will examine levels of parent-offspring agreement over traits that are considered necessities in an in-law/spouse compared to traits that are considered luxuries, and demonstrate that parents and offspring show greater

agreement over necessary traits in an in-law/spouse and show more disagreement over less important but still desirable traits.

There may also be cases in which arranged marriages are preferred by both parents and offspring. If an individual is not able to find a preferred mate for themselves, then allowing parents to arrange a match might be optimal compared to remaining mateless. For instance, an individual who is less attractive or from a lower-status family may be able to find better matches via their parents' search and negotiations than through their own efforts and, thus, may prefer arranged marriages. Individuals may also prefer arranged marriages when there is a sizeable benefit tied to arranged marriage. For example, in societies with male primogeniture, oldest sons who stand to inherit large fortunes may be more motivated than later born sons to have an arranged marriage because the cost of losing such resources is higher than the cost of not getting the most compatible genes in a self-chosen mate.

1.F. Sex differences in arranged marriage preferences and outcomes

Some data indicate that women experience more parent-offspring disagreement over the qualities in a potential spouse than do men, and this disagreement appears to be more pronounced for daughters and fathers than daughters and mothers (Dubbs et al., 2013). Daughters seem to experience the largest disagreements over physical attractiveness of a potential spouse, preferring it much more than do their parents (Bovet et al., 2018). Conversely, parents show higher preference for physical attractiveness in a daughter-in-law than in a son-in-law (Apostolou, 2010a), indicating that sons may be more likely than daughters to achieve this criterion even in arranged marriages because parents of sons are valuing it higher. Because physical attractiveness can be a sign of genetic quality, individuals

unable to exhibit preferences for attractiveness may lose out on genetic fitness benefits. Parents also attempt to influence their daughters' mate choice more than their sons' mate choice through various manipulation tactics (Apostolou & Papageorgi, 2014).

Men and women also have different opportunities to exercise independent choice before and after marriage. Women tend to be married younger than men, which can give women less bargaining power in negotiations with their parents than men would hold. Women also face harsher punishments for extrapair mating than men do in many contexts. For example, a man's infidelity is a cause for divorce in fewer societies than is a woman's infidelity (Betzig, 1989). In places like Nepal, the focus of this dissertation, it is also not socially acceptable for women to remarry, even as a widow. Based on this, men appear to have less to lose from entering arranged marriages than do women because their preferences are more aligned with their parents and they maintain more options for obtaining additional mates beyond the arranged marriage.

Why then, are arranged marriages more common for women than for men cross-culturally? Arranged marriages provide several benefits, like additional social support, higher marriage payments, and access to inheritances, to name a few. These benefits may be especially salient for women, whose fitness is more closely tied to access to resources that can be invested in offspring. Because women in many cultural contexts often have fewer opportunities to earn wealth independently than do men, marital sources of these resources are especially important. Arranged marriages may also provide women higher social status than do elopements, and social status can be beneficial for fitness outcomes (e.g., Alami et al., 2020). While women may have less opportunity to exhibit their preferences for physical attractiveness, especially when married at young ages, they may make up those costs through

other benefits of arranged marriage. When given the option, some women likely prefer arranged marriages if the benefits of arranged marriage outweigh the costs.

1.G. Detecting the fitness benefits of mate choice in humans

The fitness effects of mate choice in humans have not been as extensively studied as the effects of mate choice in other animals (reviewed above). Across and within three societies (the Yali, Tsimane, and Bhotiya), no differences in surviving or dead offspring were detected when comparing arranged and non-arranged couples (Sorokowski, Groyecka, et al., 2017). Conversely, analysis of the Indonesian Family Life Survey showed that arranged couples have slightly fewer live births, consistent with predictions, but did not find any effect of marriage type on other outcomes such as birth weight (Hasnain, 2020). However, both of these studies treat arranged marriage and non-arranged marriage as a binary variable, which does not capture the range of variation in spouse choice. These studies also only examine a small set of possible fitness outcomes, unlike many of the experimental animal studies. There is some evidence that love, measured by intimacy, passion and commitment, does influence reproductive success (Sorokowski, Sorokowska, Butovskaya, Karwowski, & Stephen, 2017); however, love could occur in both arranged and non-arranged marriages. Thus, the effect of free spouse choice on human reproductive fitness remains unclear. Chapter 3 will explore this question further with new analyses based on a large sample of marriages in the Chitwan Valley, Nepal, testing whether free mate choice increases reproductive success by comparing total births, offspring survival, and birth timing for women in arranged, co-selected, and self-selected marriages. These analyses will confirm the previous null results, finding no differences between marriage types in any fitness measure. This result, in combination with

the two previous studies, suggests that the communal breeding system of humans (Bogin, Bragg, & Kuzawa, 2014; Hrdy, 2006; Kramer, 2010; Sear & Mace, 2008)—with many individuals contributing to the survival and ultimate reproduction of progeny—may provide compensatory benefits that make relinquishing free mate choice a viable strategy in some contexts. To disentangle the complex relationships between spouse choice and its associated social, economic, and genetic effects, this dissertation will focus on Nepal, using rich qualitative and quantitative data sources.

1.H. The ethnographic context of Nepal

Chapters 3-5 focus on arranged marriage in Nepal, and thus the ethnographic context of the nation and the communities of interest form the relevant frame for the findings presented here.

1.H.i. History and Demographics of Nepal

Probably due to its montane setting, Nepal was able to maintain independence during most of South Asia's colonization period. The country opened its borders to foreigners only in the 1950's, with a subsequent influx of western media, NGOs, and foreign development workers. This exposure produced a cultural shift, affecting education, industry, marriage practices, and perceptions of autonomy and choice (Ahearn, 2001). More recently, Nepal has experienced increasing out-migration for higher education and for manual-labor jobs, which jointly produced a substantial increase in capital due to remittances.

Nepal is over 81% Hindu and 9% Buddhist, with the remaining 10% distributed between Islam, Christianity, and folk religions (*Nepal Population and Housing Census 2011*,

2012). The country is ethnically diverse, with over 125 castes and ethnicities reported in the most recent census, with the most common being Chhetri (17%) and Brahmin (12%). Many ethnic groups in Nepal are geographically isolated due to the terrain, which ranges from tropical lowlands, to forested foothills, and to the high Himalayas. Roughly 45% of the population speaks Nepali as their mother tongue, but there are over 120 other primary languages spoken in the country (*Nepal Population and Housing Census 2011*, 2012).

Nepal has a literacy rate of 71%, and virtually universal primary school completion in recent cohorts (World Bank, 2023). Life expectancy at birth is 69 years. There is a 40% labor force participation rate and a GDP per capita of $1,208 USD, ranking among the lowest in South Asia on both of these economic scales (World Bank, 2023). Approximately 90% of households in Nepal have access to electricity and drinking water services. An estimated 47% of married women aged 15-49 use contraceptives in Nepal. The maternal mortality rate is 186 per 100,000 births. These national numbers can vary substantially between districts and between rural and urban populations. The total fertility rate (TFR) in Nepal has fallen dramatically over the past few decades, from 4.6 in 1996 to 2.1 in 2022 (*Nepal Demographic and Health Survey Key Indicators Report*, 2022). TFR is currently higher in rural areas (2.4 births per woman in rural areas and 2.0 in urban areas) (*Nepal Demographic and Health Survey Key Indicators Report*, 2022).

1.H.ii. Caste and Ethnicity

Caste and ethnicity are important criteria for arranging and approving marriages in Nepal, and baseline knowledge of the caste system will be important for understanding Chapters 4 and 5 of this dissertation. Nepal uses a similar caste system as other parts of South

Asia (see Figure 1.1), but it has been altered to include other ethnic groups (Höfer, 1979). The advantaged castes include *Bhaun* (also referred to as *Brahmin*) and *Chhetri* (elsewhere referred to as *Kshatriya*). The Tibeto-Burman ethnic groups (e.g., Newar, Tamang, Magar) are typically included in the middle *Matwali* level, although some ethnic groups also have their own internal caste systems. All the aforementioned groups would be classified as *pani chalne*, meaning a group from which it is okay to accept water to drink. Disadvantaged castes in Nepal (*sano jaat*) include tailors, smiths, etc., which are subdivided into touchable and untouchable categories. These groups are designated *pani nachalne*, meaning their water cannot be accepted by members of other castes.

Hindu marriages are traditionally limited to members of the same caste and subcaste, but members of the same *gotra* (lineage) are not eligible marriage partners. Last names often help individuals discern caste or ethnic affiliation, although it is not always clear. While children often inherit their caste from their father, their designation may sometimes be changed based on characteristics of their mother, despite hypergamy being formally permitted. For example, the Khatri-Chhetri caste in Nepal can signify a marriage between a Brahmin man and Chhetri woman at some point in the lineage (Höfer, 1979).

Figure 1.1: Nepali caste system, adapted from Bennett, 1983

Sanskritic Equivalent	Nepali Caste Groups	Caste (Jaat)	Category
Brahmin	Brahmin or Bahun	Upadhya Brahmin Jaisi Brahmin	*Pani chalne* (water acceptable)
Kshatriya	Thakuri, Chhetri	Khatri-Chhetri Chhetri	
Vaisya	Matwali*	Newar** Gurung Magar Tamang Chepang Tharu	
Sudra	Touchable	Dhobi Kasai	*Pani nachalne* (water not acceptable)
	Untouchable	Kami Sarki Damai	

*Contains two major subcategories
**Some Newars are categorized as Chheti and some as Sudra based on Newari caste system

1.H.iii. Marriage traditions and laws in Nepal

Hindu marriages are traditionally seen as a union between two families, rather than a union between a couple (Banerjee, 1984). Prior to marriage, it is common for bride's and groom's families to consult an astrologer, who will check their horoscopes and *gotras* for compatibility. Marriages are traditionally formalized in multi-day ceremonies, with separate rituals at both the bride's and groom's homes. Marriage traditions vary slightly in different ethnic groups. For example, members of the Tamang ethnic group traditionally marry cross-cousins (Fricke, 1990). However, arranged marriages are widely practiced across most Nepali castes and ethnicities.

Nepalis traditionally practiced dowry, or payment from the bride's family to the groom's family. In the past, the groom's family could request certain gifts or sums of money to be included in the dowry, but Nepal has made this practice illegal since 2009. While it is illegal, dowry still exists in some parts of Nepal. In some families, dowry has morphed into gift-giving, where the bride's family will give her gifts of their choosing, which she brings with her to her husband's home, where she typically resides (see Chapter 4). Unlike traditional Nepali dowries, which would have become the property of her husband's family, the bride owns and controls these items. Thus, while formal dowries may not be common, marital gift-giving from the bride's family is still very popular in Nepal.

There has been a secular shift in Nepal away from arranged marriages in recent years (Ghimire, Axinn, Yabiku, & Thornton, 2006) and more acceptance of ideas about love and autonomy in marriage decisions (Ahearn, 2001). The age of marriage in Nepal has also risen over the past several decades (Ghimire et al., 2006). The legal age of marriage in Nepal is currently 20 years old for both men and women (or 18 with parental consent), although this law is not well enforced in many areas of the country, and "underage" marriages, mostly among 16-20 year olds, may be informally recognized in the community without being legally registered.

The divorce rate in Nepal is less than 1% (*Nepal Population and Housing Census 2011*, 2012), despite divorce being a legal option for both men and women. In the case of divorce or a spouse's death, remarriage is an option for men, but women very rarely remarry. It is not uncommon for widows to stay with their husband's family after his death. Thus, the decision about whom to marry is effectively permanent in Nepal, especially for women.

1.H.iv. Chitwan and Dhading- The two communities of interest

Chapter 3 uses data from the Chitwan Valley Family Study (CVFS) (Axinn et al., 2022). Chitwan is a district located in the tropical lowlands of Nepal. It is near the border with India, and thus has much linguistic and cultural influence from North India. Chitwan receives a large amount of international tourism due to the Chitwan Valley National Park, but the primary source of income is from agriculture. The area has access to major highways, markets, healthcare, and public education. The castes and ethnicities with the highest representation in the CVFS sample are Brahmin (34%), Chhetri (10%), Tharu (13%), Gurung (7%), Tamang (7%), and Newar (7%).

The Dhading District is just west of Kathmandu, the capital city of Nepal. The Tribhuvan Highway, the main road connecting Kathmandu to the western half of Nepal, runs through this district. Communities located close to the highway engage in small businesses, such as shops, restaurants, or auto repair. Communities farther from the highway are primarily engaged in agriculture. Because of the proximity to Kathmandu, there is good access to markets, higher education, and infrastructure (i.e., electricity, internet) throughout the area. In the specific community where data were collected in Dhading, the castes and ethnicities with the highest representation are Brahmin (25%), Chhetri (23%), Tamang (28%), and Newar (7%) (*Nepal Population and Housing Census 2011*, 2012). 74% of the population speaks Nepali as their mother tongue, and 20% speak Tamang (*Nepal Population and Housing Census 2011*, 2012). Dhading will be the primary focus of Chapters 4 and 5.

While the Chitwan Valley and the Dhading District are two distinct communities (See Figure 1.2), they share many cultural and demographic similarities. The districts share a mutual border and are both part of Bagmati province. Both communities are primarily

agricultural, but with a growing small-business industry. Literacy rates are higher in Chitwan (Dhading=65%, Chitwan=77%), but primary school completion is higher in Dhading (Dhading=42%, Chitwan=32%) (*Nepal Population and Housing Census 2011*, 2012). Both areas have access to local health posts that offer basic medical care, prenatal services, birthing centers, and contraception. Both areas also have high representation of Brahmin and Chhetri castes. Based on my fieldwork, it is not uncommon for individuals from Chitwan to marry individuals from Dhading (and vice versa). Thus, while the results from one location do not always generalize to the other, the people in these areas likely share many similar beliefs and practices about marriage, spouse choice, and family.

Figure 1.2: Map of Districts in Nepal

(1) Chitwan District and (2) Dhading District. Map modified from "Districts of Nepal 2020" by SNOW977, published open source via Wikimedia Commons, 2021.

1.I. Outline of the dissertation

The dissertation will explore the relationships between parental choice in arranged marriages and the potential associated fitness outcomes in several steps:

Chapter 2: Arranged Marriage Often Subverts Offspring Mate Choice: An HRAF-Based Study as published in *American Anthropologist*

In this chapter, I will demonstrate that parents and offspring regularly exhibit disagreement over the particular choice of spouse in every world area by using data from 550 ethnographies in the Human Relations Area Files. These ethnographic data will also demonstrate that parents often prefer spouses that increase access to social networks, alliances, prestige, or financial resources while offspring are more focused on the potential match's physical appearance, personality, or feelings of love. I will also show that accepting or refusing an arranged marriage can have fitness relevant consequences by examining the outcomes of disagreements over spouse choice. Based on these cross-cultural data, the baseline expectation is that use of arranged and non-arranged marriages as a proxy for limited and free mate choice should reveal the theorized (and observed in non-human animal studies) fitness differences.

Chapter 3: Arranged and non-arranged marriages have similar reproductive outcomes in Nepal

In Chapter 3, I use data from the Chitwan Valley Family Study (CVFS) to examine whether variation in spouse choice is associated with differences in offspring survival or timing of reproduction in a sample of over 1,200 married women. This chapter will

demonstrate that having an arranged, co-selected, or self-selected spouse is not associated with any differences in number of births, offspring survival, or interbirth intervals. These results are in line with previous studies (Hasnain, 2020; Sorokowski, Groyecka, et al., 2017), and this indicates that humans do not fit the predictions derived from mate-choice theory and experimental animal studies. Further descriptive statistics from the CVFS indicate that parents and offspring may display general agreement over the qualities of a potential in-law/spouse and that couples in different types of marriages experience similar levels of love and compatibility, which may signal that different modes of spouse choice do not lead to different qualities in a spouse or relationship quality, limiting the effects of mate choice on fitness outcomes.

Chapter 4: Socioeconomic benefits and limited parent-offspring disagreement in arranged marriages in Nepal, as published in *Evolutionary Human Sciences*

In this chapter, I will use data generated from focus groups carried out in Dhading, Nepal to investigate possible reasons why previous studies (e.g., Chapter 3) do not show fitness reductions in arranged marriage, as would be predicted by results from experimental animal studies. This chapter will investigate the emic categories of marriages in Dhading, Nepal, which differentiate between arranged marriages, love marriages and elopements. I will then examine the domains of parent-offspring disagreement over the qualities of an ideal in-law or spouse, respectively, and demonstrate that parents and offspring express a high amount of agreement over these ideals—or that agreement is an ideal in itself-- especially between sons and their parents. I will then demonstrate that arranged marriages are accompanied by several other socioeconomic benefits that could increase fitness, such as

greater marital gift-giving and increased social support, and these benefits could compensate for fitness losses from not choosing a spouse independently.

Chapter 5: Disparities and Similarities in Parent and Offspring Preferences in an In-Law or Mate

This chapter will quantitatively probe the differences in in-law and spouse preferences for parents and offspring, respectively, in Dhading, Nepal. For this study, parents and offspring allocated high and low budgets to build their ideal in-law/spouse from a set of 14 traits. By comparing the amount allocated to each trait, domains and magnitude of parent-offspring disagreement can be identified. The amount of overlap between parent and offspring preferences across all 14 traits was determined by calculating the multi-variate Mahalanobis Distance (D) between groups. This chapter will demonstrate that parents and offspring generally disagree over the ideal traits in an in-law/spouse, that parents and daughters disagree more than parents and sons, but that parents and offspring overall show more agreement over necessities in an in-law/spouse and more disagreement over traits considered luxuries.

I will attempt to synthesize these various findings and suggest future research direction in a final chapter.

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Chapter 2: Arranged Marriage Often Subverts Offspring Mate Choice: An HRAF-Based Study

Authored By:

Elizabeth Agey

Addison Morris

Maya Chandy

and

Steven J.C. Gaulin

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2.A. Introduction

Arranged marriage—where parents (or other kin) choose marriage partners for their progeny—is ethnographically widespread in both indigenous and diaspora populations. Depending on the dynamics of agreement or disagreement about partner choice between the arranging parents and the marrying offspring, such marital arrangements may have enduring effects on relationships between married couples and their parents, as well as the between married partners themselves, and may also rebound to the wellbeing of any resulting offspring. Researchers working in societies where at least some marriages are arranged—as we are in Nepal—may benefit from a wider perspective on its distribution and the associated parent-offspring dynamics that can be gleaned from a broad survey of the ethnographic record.

As a baseline, the frequency of arranged marriage can be estimated from the Standard Cross-Cultural Sample (SCCS), a well-documented set of 186 cultures chosen to be relatively independent of each other and broadly representative of subsistence types and world areas (Murdock and White 1969). Broude and Greene (1983) added two variables to the SCCS for arranged marriage, one from the male and one from the female perspective. Leaving aside the minority of societies where Broude and Greene could not determine the mode of marriage, 46 of 157 SCCS societies (29.3%) consistently practice and an additional 28 (17.8%) sometimes practice arranged marriage for sons; whereas 71 of 161 (44.1%) consistently and 28 (17.4%) sometimes practice arranged marriage for daughters (see also Shenk 2017). Moreover, comparative evidence suggests that arranged marriage may not be a recent innovation. In comparing 190 hunter-gatherer societies (186 with complete data), Apostolou (2007) found that 69.9% had arranged marriages by the parents and an additional

17.7% had marriages arranged by other close kin. Using phylogenetic-reconstruction analyses Walker et al. (2011) concluded that "arranged marriages probably have a history going back at least 50,000 years" (Walker et al. 2011, 2).

Walker et al. (2011) note that arranged marriage often creates webs of reciprocal exchange among different lineages and thus underpins alliances and group structure. However, any form of marriage builds alliances, and the question remains why parental priorities in doing so have come to the fore in many cultures, and what the consequences of these practices might be (Apostolou 2007; Shenk 2017). Moreover, while these anthropological studies attest to the frequency and potential time depth of arranged marriage they have not yet attempted to address the extent to which arranged marriage subverts offspring mating preferences: How often do parents choose a mate *different* from the one who would have been chosen by their son or daughter? As we will argue below, the answer to that question is of considerable evolutionary importance.

Parents plausibly have considerable incentive to marry their children to good partners: By virtue of their genealogical relationship, parents and their offspring share 50% of their genomes, and thus their fitness interests overlap. However, complete concordance of interests is not expected from theory nor observed in practice. *Parent-offspring conflict* (Trivers 1974) is predicted because relatives do not share *all* of their genes, a fact which is expected to produce significant strategic divergence (Alexander 1974, Fouts et al. 2005; Haig 1993; Schlomer et al. 2011; Trivers and Hare 1976), with each actor behaving in ways that maximize his or her own inclusive fitness at the expense of other family members (Hamilton 1964a, b). Although the magnitude of such parent-offspring conflict would be reduced in less promiscuous/polygynous populations (Bossan et al. 2013), a substantial zone of fitness

conflict remains even in fully monogamous cases. For example, parents could use arranged marriages to create or solidify alliances, to gain access to land, herds, hunting grounds or other resources, or to acquire additional mates for themselves or their other offspring (Apostolou 2007; Shenk 2017). These parental strategies are not expected to maximize the fitness of any individual offspring but instead to increase parental fitness via maximizing total grandchild production. Even if they were to prioritize their offspring's interests, parents will not express various quality-detection mechanisms designed to operate during pairing (Apostolou 2007) for example, being unable to implement genotype-specific priorities related to major-histocompatibility-complex discordance, which by definition produces unique preferences in each individual (Penn and Potts 1999; Winternitz et al. 2017). Thus, parent-offspring conflict over mate choice is of special interest because comparisons of outcomes between arranged and non-arranged marriages has the potential to uncover possible fitness benefits of mating preferences. A brief review of the related literature from non-human animals makes this perspective clear.

Humans are not alone in preferring certain mates over others: Strong mating preferences are a conspicuous feature of reproduction across a wide array of sexual species (Andersson 1994, Darwin 1871, Hamilton and Zuk 1982). Inevitably, the implementation of these preferences entails neurological, temporal, and risk costs. Nevertheless, such preferences are thought to evolve and be maintained despite these costs because, in net, they provide direct or indirect fitness benefits to the chooser (Andersson 1994, Andersson and Iwasa 1996, Kirkpatric and Ryan 1991, Kokko et al. 2003, Penn and Potts 1999). If this perspective is correct, it follows that any limitations on the expression of these evolved mating preferences should reduce fitness.

This key prediction, on which the entire human and non-human mate-choice literature logically rests, has been tested in 28 experimental studies across various animal taxa including insects, fish, birds, and mammals. These studies use a variety of experimental designs, all intended to assess the fitness benefits associated with the expression of an evolved mating preference. In some studies, the control group was allowed to choose from an array of mates while the experimental group was assigned a mate at random. In others, individual preference was assessed, and subjects were mated with either their preferred or non-preferred mate. Tabulating across all 28 animal studies, 198 fitness components were examined. Of this total, 76 fitness components were significantly higher in the group allowed to exercise free mate choice versus 8 that were significantly higher in the group where mate choice was constrained. The fitness components most frequently associated with benefits to mate choice include offspring survival to various ages (e.g., Anderson, Kim and Gowaty 2007; Gowaty, Drickamer and Schmid-Holmes 2003; Partridge 1980), offspring growth rates (e.g. Havens, Orzack and Etges 2011; Reynolds and Gross 1992; Sandvik, Rosenqvist and Berglund 2000), and offspring resistance to infection (Raveh et al. 2014). The weight of evidence from these experimental studies with non-human animals thus suggests that mating preferences have evolved because of the significant fitness benefits they provide to the chooser.

Thus, beyond its ethnographic and cultural significance, arranged marriage may offer a parallel with the above experimental studies of the fitness benefits of free mate choice in other animals. This would be true, however, only if the parents arranging the marriages select *different* mates for their offspring than their offspring would select for themselves (Apostolou 2007), because only then would the evolved preferences of the mated pair be thwarted.

At present, on admittedly scant evidence, arranged marriage does *not* seem to compromise fitness. Two studies, spanning four societies (Tsimane, Yali, Bhotiya, and Nepalese), have attempted to use arranged marriage in this way. In each society individual marriages were sorted into two groups—arranged and free-choice—but no fitness differences were observed between the two groups (Agey and Gaulin 2018; Sorokowski et al. 2017a). Specifically, the number of surviving children, the number of deceased children, and the timing of reproduction did not differ between arranged and free-choice marriages in any of these four societies. Why might free mate choice augment fitness in other animals but not in humans? One important possibility is that arranged marriage does not significantly disrupt pairing outcomes because human parents and offspring do not disagree over partner choice. In other words, mate choice might not be a domain of parent-offspring conflict. Of course there are many other possible explanations for this null result, some of which make interesting predictions about cultural dynamics. For example, perhaps those parents whose offspring acquiesce to parental preferences invest more reproductively relevant resources (e.g., land, herds) in their offspring's marriages. Additionally, parents being older, with longer experience in the community, may better recognize the most useful alliances, and perhaps the benefits derived from alliances with the "right" affinal groups are more important to fitness outcomes than are the benefits of free mate choice (Shenk 2017). The logical first step in exploring these and related issues is to determine the relative frequency of parent-offspring agreement and disagreement over partner choice.

Although our focus is on disagreement over mate choice, such disagreements plausibly arise from discrepant preferences of parents and offspring. Almost all of the large relevant literature focuses on the preferences of the mating individuals. Physical

attractiveness, economic resources social standing, and age are all key preference criteria whose importance varies somewhat from place to place and between the sexes (Li et al. 2002; Buss and Schmitt et al. 2019; Conroy-Beam and Buss 2019; Lassek and Gaulin 2019), though some show substantial cross-cultural stability (Shackelford et al. 2005). These well documented preferences seem to differ from those of parents. At least in the predominantly Western societies where they have been studied (where arranged marriage is relatively rare), parents and their marrying offspring differentially prioritize physical attractiveness (Apostolou 2008a), marriage age (Apostolou 2010a), and family background (Apostolou 2008b). Perilloux et al. (2011) compared preferred traits of US college students choosing a partner to the preferences of their parents choosing a partner for their offspring. While they found general agreement over traits such as kindness, they also found that parents were more likely to prefer similar religious and ethnic background, while their children placed more emphasis on physical attractiveness, traits which the authors deem relevant to fitness outcomes. Apostolou (2015) also found the same dimensions of parent-offspring disagreement in a sample of Greek-Cypriots. Parallel results have been obtained by asking participants to predict their parents' preferences in a variety of cultures (Buunk, Park, and Dubbs 2008; Buunk and Castro Solano 2010; Dubbs and Buunk 2010).

But few studies have examined the mating preferences of parents and offspring in societies where arranged marriage is common. One exception is a study conducted in an arranged-marriage market in China which found disagreement only between parents and daughters, who preferred physical attractiveness more than their parents did (Bovet et al. 2018). Another study of Chinese immigrants to North America also shows more valuation of attractiveness by offspring than by parents while parents placed a higher priority than their

offspring on mates who were “traditional” (Hynie, Lalonde and Lee 2006). Studies of Ju/’Huansi arranged marriages, however, show little overt disagreement over attractiveness of a potential spouse, and most disagreement results from daughters feeling they are too young to marry (Wiessner 2009).

The above studies, some of them indirect, suggest that parents and their offspring have (or expect each other to have) different *priorities* when choosing mates. However, the question we are foregrounding is, do parents *select different partners than the offspring would select for themselves*. Only if they did would arranged marriage be expected to lower offspring fitness. Because our question concerns the *typical* effects of arranged marriage, rather that its detailed dynamics in any particular society, we implemented a broader approach. Intentionally considering the full variety of cultures and world areas, we examined the presence/absence of parent-offspring disagreement concerning spouse choice in arranged-marriage societies in the Human Relations Area Files (HRAF) World Cultures database—a collection of digitized and indexed ethnographies grouped by eight world areas. Our study was undertaken because, in line with parent-offspring conflict theory (Trivers 1974), we expected that parents and offspring would often disagree over mate choice. An opposite result, showing general parent-offspring agreement, would suggest that arranged marriage may not limit the expression of evolved mating preferences. Moreover, since no systematic survey of this type has been done, we imagined that our findings could be relevant to a wide variety of collateral ethnographic questions about pair formation, spousal relationships, courtship, family relations, divorce, parenting, and societal alliance structures. Thus, the limited but important goal of the present study is to determine how often parental influence conflicts with offspring mate choice. The larger issue of whether arranged marriage reduces

offspring fitness could not be addressed with the HRAF database, and would be a defensible question only once the level of disagreement was established.

2.B. Methods

The HRAF World Cultures database has pre-coded a large number of cultural practices and attributes via its OCM codes, including OCM 584, "arranging a marriage". Unfortunately, this category includes any type of marital "arrangements" (e.g., courtship processes, ceremonies, feasting, behavior of the betrothed), and does not uniquely identify cases of spouse choice by parents. However, the HRAF database also allows researchers to specify any number of Boolean search terms and, with those constraints, selects relevant paragraphs from the indexed ethnographies (6,019 documents from 320 cultures, at the time of our review). Thus, we elected to bypass OCM identifiers and used a customized search strategy (below) to capture the full array of cases where the marrying couple's partner choices could potentially be in conflict with those making the choices and, from those cases, tabulated the relative frequency of agreement and disagreement. Where there was disagreement, we also coded the reasons for conflict over spouse choice as well as the outcomes of those disagreements, where the ethnographer included such information. Our primary goal was to assess whether general parent-offspring agreement (rather than disagreement) might explain the finding (Agey and Gaulin 2018; Sorokowski et al. 2017a) that arranged marriage has no obvious fitness consequences.

We elected to examine only texts from societies where arranged marriage was reported by the ethnographers because these are the cases where parents have the greatest potential scope and authority to overrule their offspring's evolved mating preferences. Thus,

we searched the entirety of the HRAF for the intersection of the two words “arranged” and “marriage” with sets of additional search terms (see Table 2.1). For each such search, the HRAF returned all paragraphs that included the words “arranged” and “marriage”, plus the individual search term(s). We grouped similar terms together (e.g. “elope” OR “escape”), calibrating the searches to return paragraphs if they contained either term. In addition, to minimize bias in our search strategy, we chose both positive and negative search terms (e.g., both “fight”, “argue”, “murder” and “love”, “passion”, “harmony”). Balance was further augmented by the fact that many of the returned paragraphs contained effective negations of the search term (e.g., “…there was no harmony…”, “…fighting was very rare…”). As described below, our analysis of the HRAF material proceeded from the lowest level, of individual paragraphs, to ethnographies, and finally, to unique cultures.

2.B.i. Coding

Paragraphs

The HRAF searches shown in Table 2.1 returned a total of 1,801 paragraphs (some of which were duplicates because they satisfied the criteria of multiple searches). These 1,801 paragraphs were our raw data, and we began by coding each of them for the presence of agreement or disagreement over partner choice according to the following criteria, also illustrated in Figure 2.1.

Table 2.1: Paragraphs returned in HRAF by search term and world area.

Search Algorithm	Paragraphs by World Area								
Arranged + *Marriage* +	Africa	Asia	Europe	Middle America	Middle East	North America	Oceania	South America	Total
conflict or *disagree*	17	35	7	5	9	17	5	6	101
promiscuity or *adultery*	10	6	0	1	0	11	3	1	32
elope or *escape* or *suicide*	42	49	11	5	6	34	15	10	172
divorce or *annulment*	66	105	6	4	18	59	27	11	296
fight or *argue* or *murder*	21	23	10	2	10	9	11	5	91
infanticide	1	1	0	0	0	1	0	0	3
love or *passion* or *harmony*	56	147	27	15	31	45	26	14	361
children or *fertility*	133	212	35	16	47	141	74	30	688
happiness or *contentment*	4	5	0	0	2	5	0	1	17
intercourse	8	10	0	3	1	10	6	2	40
Total	358	593	96	51	124	332	167	80	1801

Number of paragraphs (n=1,801) returned by HRAF for each set of search terms (in italics) and their distribution by world area. The terms “arranged” and “marriage” were used in every search. Each returned paragraph contained the words “arranged”, “marriage”, and at least one of the conjoined search terms. The search also returned paragraphs containing variations of the search terms, such as “arrange” and “arranging”.

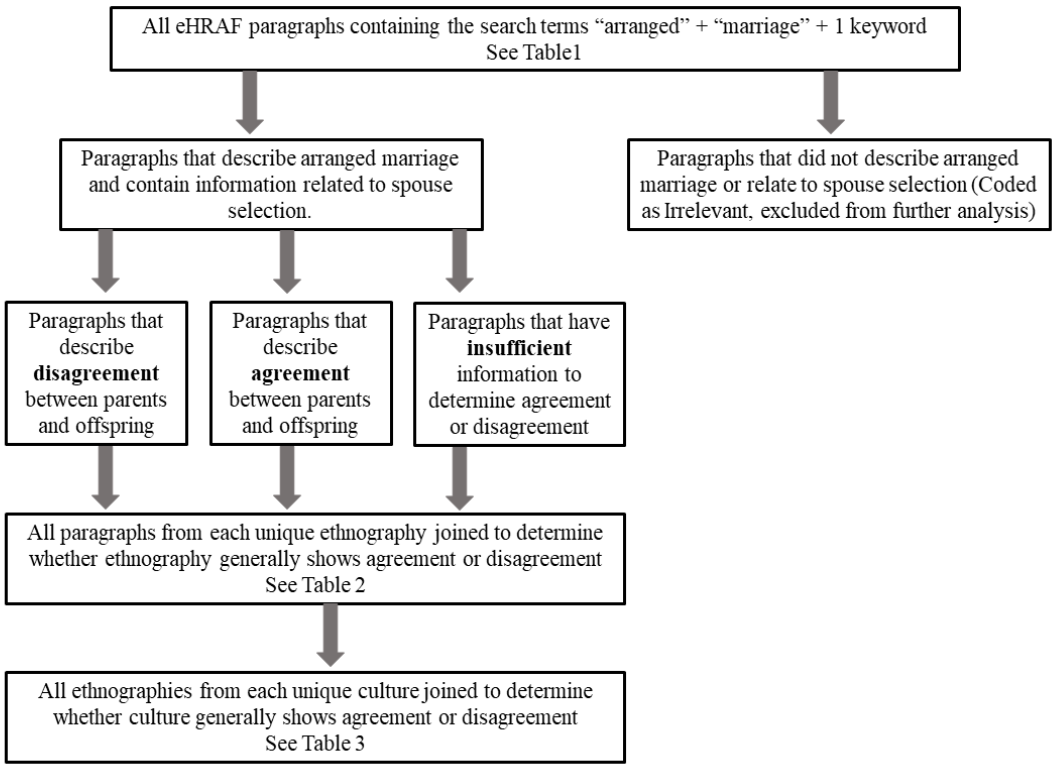
Agreement: A paragraph was coded as “agreement” if the parent (or relative selecting the mate) and the marrying individual agreed on the chosen partner. If the reported domestic harmony was not directly related to mate choice, the case was coded as “insufficient information”. An example of a paragraph coded as “agreement” is:

> "Marriage usually takes place between the ages of fifteen and twenty, and is generally arranged by the parents of the boy and girl concerned. The children are, however,

> consulted and are never forced to marry against their will; but at this age they do not seem to have any very strong likes or dislikes, and seem usually willing to marry anyone whom their parents suggest ... They settle down quite comfortably." Morris (1938, 220-21) writing about the Lepcha.

This paragraph suggests that, among the Lepcha, offspring agree with their parents about spouse choice.

Figure 2.1: Flow chart illustrating the selection criteria and coding process for the data in Chapter 2



Disagreement: A paragraph was coded as "disagreement" if the parent (or relative selecting the mate) and the marrying individual disagree on the chosen partner. If the reported disagreement was not directly related to mate choice, the case was considered "insufficient

information". Key phrases indicating disagreement included "conflicting interests", "disparate views", or "different wishes" in regards to spouse choice. An example of a paragraph coded as "disagreement" is:

> "Meanwhile they do not neglect the home front, and by the incessant advocacy of their loved one, the tearful rejection of all others, and the persuasive threat of suicide, they often achieve marriage earlier and to a different spouse than their parents had intended." Brow (1978, 78) writing about the Vedda.

This paragraph suggests a strong offspring desire to marry a different person than the one chosen by their parents.

Insufficient information: A paragraph was coded as "insufficient information" where it was unclear if the described marriage was arranged, or if the nature of any reported disagreement could not be determined. An example of a paragraph coded as "insufficient information" is:

> "Marriages were generally arranged, with infant betrothal not uncommon. In the post-contact period, marriages are by free choice, although the fathers of both the groom and bride are involved in approving and making arrangements for the marriage. ... In the past, many marriages ended in divorce, which could be initiated by either party for virtually any reason. The Roman Catholic church has made divorce more difficult and less frequent." Schiefenhövel (2016, 5) writing about the Rapa Nui.

Here the paragraph is coded as "insufficient information" because it is unclear whether parents and their children agree over spouse choice, and it is unclear whether the shift away from divorce is associated with the shift to free choice marriages or simply due to increasing religious influence.

Irrelevant: A paragraph was coded as "irrelevant" when the search terms were present but unrelated to mate selection, (e.g., discussions about "arrangements for the marriage feast"), the marriage described was not arranged, or the passage was not a description of real events (e.g., a myth, film, song, etc.). Of the 543 unique ethnographies that resulted from our searches, 205 of those ethnographies only contained paragraphs coded as "irrelevant". Paragraphs coded as "irrelevant" are not included in analyses or figures.

Because our prediction, based on Trivers (1974), is that there will be substantial parent-offspring disagreement, we implemented a coding scheme intended to be conservative in relation to that expectation, classifying a paragraph as indicating "disagreement" only when the disagreement was explicitly related to opposing views about the suitability of the spouse, since parents and offspring may disagree about diverse issues.

Paragraphs were initially coded by A.M. or M.C., who cross-validated each other's coding and discussed any cases where their coding was different. Cases in which A.M. and M.C. were unsure or could not reach a consensus coding, were discussed among all four of the authors in weekly meetings. Decisions on difficult coding cases were recorded to maintain consistency if similar cases were seen again. Rare paragraphs (fewer than 10 in the data set) for which a four-way consensus could not be reached were coded as "insufficient information".

Ethnographies

Our initial searches often captured multiple paragraphs from a single ethnography. Thus our 1,801 paragraphs derived from 543 ethnographies. Therefore, after the first round

of agreement/disagreement analysis (above), all coded paragraphs were aggregated by ethnography, and duplicate paragraphs returned by multiple searches were eliminated. All relevant paragraphs from each unique ethnography (i.e., each culture-ethnographer pairing) were considered together to determine whether that ethnographer judged that, in that culture, parents and offspring agreed or disagreed over mate choice. For example, an ethnography that had one or more paragraphs describing general, frequent agreement over spouse choice with one paragraph describing a case of disagreement would have been coded as "agreement" since that was the more normal pattern in the ethnography. Most ethnographies in our data set (418/543, 77%) contained only one paragraph, thus the paragraph-level and ethnography-level data in these 418 cases are identical. Of the 205 ethnographies included in our analyses below (i.e., those coded as "agreement" or "disagreement", as opposed to "insufficient information" or "irrelevant"), 147 (71.7%) included only one relevant paragraph. Of the remaining 58 ethnographies containing multiple paragraphs, there are only 7 that contained one or more paragraphs coded as "disagreement" *and* one or more coded as "agreement". In these 7 cases, we used the more frequent coding. In five of those seven cases, disagreement was described in 2 or 3 paragraphs compared to one describing agreement, and thus these were coded as "disagreement". Two ethnographies had one paragraph describing disagreement and one describing agreement; in these cases we coded them according to the more general pattern across time and space as described by the ethnographer (both were "disagreement").

Cultures

Because some cultures have been studied by multiple ethnographers, we also aggregated ethnographies by culture, again seeking consensus about whether each arranged-marriage culture was characterized by agreement or disagreement about mate choice. The 205 ethnographies included in our data set describe 119 unique cultures. Ethnographers were remarkably consistent, with 103 of the cultures in our analyses coded consistently as either agreement or as disagreement by their various ethnographers. The remaining 16 cultures were described by at least one ethnography that we coded as "agreement" and at least one ethnography that we coded as "disagreement".

Reasons for disagreement

Ethnographies that were coded as "disagreement" (n=175) were further coded as to the reasons for disagreement over spouse choice from the perspective of the parents and, separately, the perspective of the offspring. Ethnographies sometimes reported multiple reasons for parent-offspring disagreement, which generated multiple codings to represent the full set of reasons given (see example below). Many of the ethnographies contained no information about the interests of the offspring (n=66) or the parents (n=92) in selecting a spouse and thus could not be coded as to reasons for disagreement.

Outcomes of disagreement

Ethnographies coded as disagreement (n=175) were also coded for the outcome of the reported disagreement. These outcomes included which type of marriage occurred (arranged, non-arranged, both, or no marriage), the strategies taken to avoid an arranged marriage, and

the outcomes following each type of marriage. Because ethnographers may be biased in their interests or viewpoints, these codes are not meant to be representative or comprehensive. Rather, they provide a summary of the types of outcomes described in our sample. For example, outcomes like divorce or adultery are frequently described as a result of arranged marriages, but often the ethnographer does not compare these outcomes to those of non-arranged marriages. This may reflect a real difference in outcomes of different marriage types, or it could reflect a bias on the part of the ethnographer. Nonetheless, the tabulation does provide useful information about the consequences of different types of marriages and the actions taken to influence the type of marriage.

This illustrates the coding for reasons for disagreement and outcomes of the disagreement:

> "The overall result of these changes is that young men and women now have greater opportunities to arrange their own marriages, doing so with little or no consultation with parents. Parents, on the other hand, continue to expect to have a hand in marriage arrangements, often with little success. Parents in Mangrove have become upset not only because they have lost control of their daughters' marriage arrangements but also because many of these self-arranged marriages are with inappropriate partners, implying an undermining of traditional kin relations and marriage reciprocity that once formed an essential component of aboriginal social organization and social identity. Girls now have significantly altered expectations of marriage: they intend to marry only males they love or not marry at all. Also, since the missionaries have encouraged a later age of marriage, girls have the will power to confront their parents with greater conviction. In a few cases, girls may use

pregnancy as a way out of prearranged marriage." Condon (1987: 195-6) writing about the Copper Inuit.

This paragraph received multiple codings for each category. The offspring's reason for disagreement was coded as "loves a specific other person" and "wants to marry someone of the 'wrong' kinship class". The reason for parental disagreement was "want a spouse from an acceptable kin category" and "foster reciprocity/exchange/social relationships". The outcome of the disagreement in this paragraph is "non-arranged marriage", because the paragraph explicitly states that girls will not marry someone they do not choose and/or love. This paragraph would also be coded as "premarital sex (sometimes producing pregnancy)", as the last sentence says that girls may use this strategy to avoid arranged marriages.

2.C. Results

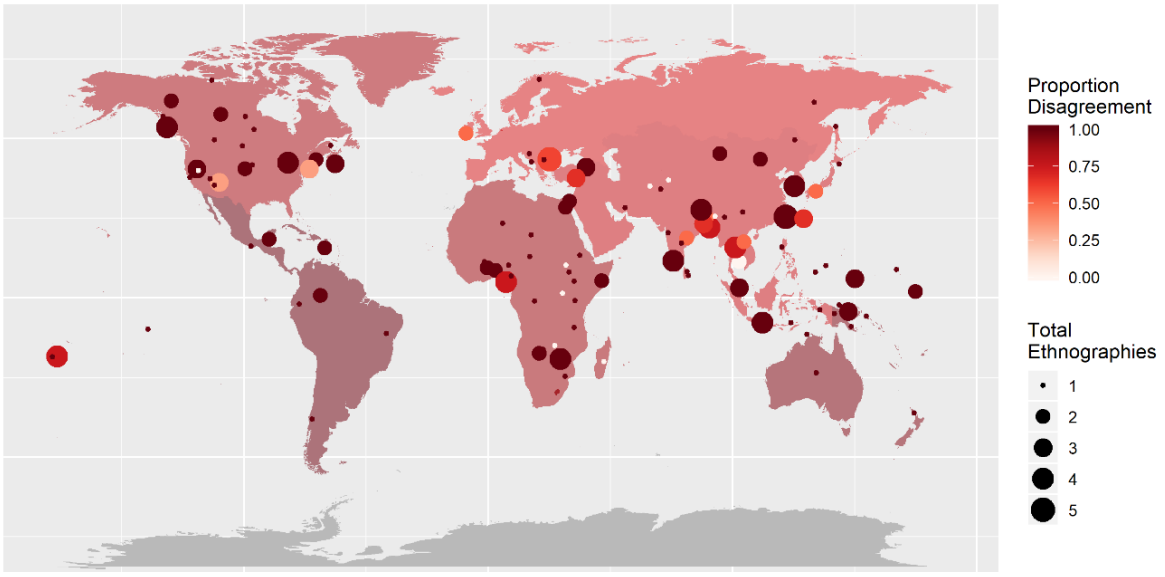
Our searches returned a total of 1,801 paragraphs across all search terms for all world areas (Table 2.1). These paragraphs appeared in 543 different ethnographies (describing 119 distinct cultures). Of the 543 ethnographies, 205 did not contain relevant information (e.g., "false hits" such as "arranged a marriage celebration"), and 133 contained information that was insufficient to code that case as "agreement" or "disagreement". Of the remaining 205 ethnographies with relevant information, 175 (85.4%) were coded as disagreement and 30 (14.6%) were coded as agreement (Table 2.2). Importantly, in each of the eight HRAF world areas, there were more cases of disagreement than agreement (Figure 2.2).

Table 2.2: Frequencies of agreement and disagreement by world area

	Excluded from Analysis		Included in Analysis		Total
World Areas	Irrelevant	Insufficient Information	Agree over Spouse Choice	Disagree over Spouse Choice	
Africa	52	23	5 (13.5%)	32 (86.5%)	112
Asia	52	35	14 (18.7%)	61 (81.3%)	162
Europe	13	9	3 (27.3%)	8 (72.7%)	33
Middle America	7	5	0 (0%)	5 (100%)	17
Middle East	11	1	1 (16.7%)	5 (83.3%)	23
North America	41	37	6 (14.6%)	35 (85.4%)	119
Oceania	20	12	1 (4.0%)	24 (96.0%)	57
South America	9	6	0 (0%)	5 (100%)	20
Total	205	133	30 (14.6%)	175 (85.4%)	543

Total number of ethnographies (n=543) by world area with frequencies of parent-offspring agreement and disagreement regarding mate choice. Percentages are based only on cases included in analysis (ignoring those with irrelevant or insufficient information).

Figure 2.2: Proportion of ethnographies coded as disagreement by culture and world area



Shading of cultures (dots) and world areas (continents) use same color scale. Points represent the approximate locations of cultures as provided by HRAF.

This pattern is replicated when aggregating at the culture level. The 205 ethnographies included in our analyses represent 119 unique cultures. Of those, 93 (78.2%) were consistently coded as "disagreement", 10 (8.4%) were consistently coded as "agreement", and 16 cultures (13.4%) had conflicting coding across ethnographies (Table 2.3). Of the 16 ethnographies with conflicting coding, eight had more ethnographies showing disagreement than agreement, two showed more agreement than disagreement, and six were equally coded as agreement and disagreement (Table 2.4).

Table 2.3: Frequency of agreement and disagreement by world area at the level of the culture

World Area	Cultures coded as both disagreement and agreement	Cultures coded only as agreement	Cultures coded only as disagreement	Total
Africa	1 (3.8%)	4 (15.4%)	21 (80.8%)	26
Asia	9 (24.3%)	4 (10.8%)	24 (64.9%)	37
Europe	2 (33.3%)	0 (0%)	4 (66.7%)	6
Middle America	0 (0%)	0 (0%)	3 (100%)	3
Middle East	1 (33.3%)	0 (0%)	2 (66.7%)	3
North America	2 (8.7%)	2 (8.7%)	19 (82.6%)	23
Oceania	1 (5.9%)	0 (0%)	16 (94.1%)	17
South America	0 (0%)	0 (0%)	4 (100%)	4
Total	16 (13.4%)	10 (8.4%)	93 (78.2%)	119

Table 2.4: Cultures with conflicting coding
All other cultures (see Table 2.3) had consistent coding (all "agreement" or all "disagreement") across ethnographies.

World Area	Culture	Number of ethnographies coded as Agreement	Number of ethnographies coded as Disagreement	Number of ethnographies coded as Insufficient
Africa	Igbo	1	3	1
Asia	Bengali	1	3	1
	Central Thai	1	3	0
	Garo	1	1	0
	Gond	1	1	2
	Lepcha	1	1	0
	Okayama	1	1	2
	Okinawans	1	2	0
	Santal	1	2	0
	Vietnamese	1	1	0
Europe	Greeks	2	3	4
	Rural Irish	1	1	0
Middle East	Turks	1	2	1
North America	Navajo	2	1	4
	Hasidic Jews	2	1	2
Oceania	Tongans	1	3	1
Total	16 cultures	19	29	18

In order for arranged marriages to be an *in*appropriate proxy for restricted mate choice in humans, parents and offspring would have to substantially agree over mate choice decisions. In our sample, 175/205 (85.4%) of the ethnographies showed disagreement over spouse choice. To go beyond simple tabulation and account for the nested structure of our data, we ran a mixed-effects regression using the glmmPQL function in the MASS package (Venables and Ripley 2002) in R Statistical Software (R Core Team 2019). The outcome variable was a binary, presence or absence of disagreement in a particular ethnography. The model included a random effect for cultures nested in world areas, to account for the (likely) possibility that ethnographic sources within the same culture and area may be similar to each other. There were 119 unique cultures within 8 world areas represented across the 205

ethnographies in our analysis. When accounting for increased similarity within cultures and within world areas, this model predicted an even higher probability of 90.5% disagreement than the tabulated level of 85.4% (above). The predicted odds of disagreement compared to agreement was 9.5 (CI: 5.8 – 15.4), indicating a strong skew towards parent-offspring disagreement over spouse choice.

Reasons for disagreement

Of the 175 ethnographies coded as "disagreement", the ethnographer did not detail the reasons that offspring disagreed in 66 cases and did not detail the parents' reasons in 92 cases. For the cases with useful data, offspring raised a variety of reasons for disagreement with their parents over spouse choice (Table 2.5). By far the most frequent offspring protest was that they loved someone else (62 cases), or that they generally wanted love or romance prior to marriage (11 cases). While these cases are interesting for their preponderance, and suggest the operation of particular psychological machinery in the offspring, further detail was systematically lacking in terms of *why* they loved someone else.

Beyond the absence of love, offspring frequently expressed dislike of their parents' choice, again, often for unspecified reasons (13 cases). When a reason was given, the most common objection was that the chosen spouse was either too old or too young (12 cases). Offspring also objected to physical qualities of the spouse; they claimed that a potential spouse was unattractive in four cases, and refused to marry someone with a physical disability in four separate cases. Offspring also objected to a potential spouse because of general incompatibility in personality (9 cases).

Offspring also frequently rejected societal rules or expectations that constrained their mate pool, preferring to marry in ways that contravened the group's prescriptions. For instance, some offspring wanted to marry ineligible kinship classes, including two cases to avoid a close relative and two cases to marry a close relative. Similarly, two cases centered around offspring wanting to marry outside their ethnic group, religious group, or caste. They also stated a desire to choose a spouse from a larger mate pool than their parents would consider (2 cases) and to marry outside of their group in order to increase status. Other reasons offspring disagreed with their parents over spouse choice included a desire to marry at a later time (3 cases), a desire to avoid a polygynous marriage (2 cases), and sexual issues or shyness (2 cases).

Parents' reasons for disagreeing with their offspring over mate choice were also diverse, but had a clearly different focus (Table 2.6), aimed at garnering economic or social benefits. Parents expressed a desire for favorable economic outcomes via wealth-enhancing marital transactions or property rights; of the 26 cases in this category only 2 explicitly highlighted economic benefits to the marrying couple, as opposed to the parents. In parallel with their economic concerns, parents also emphasized social priorities, arranging marriages to people belonging to the appropriate kinship category (18 cases), ethnic group, religion, or caste (7 cases), to those with a respected family background (9 cases), or in ways that would establish or reinforce familial alliances (17 cases), create or solidify reciprocal/exchange relationships (10 cases), or enhance their political standing, status, or reputation (12 cases). Less frequently parents also prioritized household labor, expressing desire for a son/daughter-in-law who would care for them and/or do housework (5 cases). Similar to offspring, parents also expressed general dislike over their offspring's choice, disagreeing over traits like

education, personality, and the age of the suitor. In two cases, parents expressed concern that, if allowed to make an unencumbered choice, their offspring would not make good decisions or be able to judge the character of a potential spouse.

Tables 2.5 and 2.6 are strikingly divergent. Parents never raised the issues of love or attractiveness; offspring never stressed a desire for favorable marriage transactions, economic benefits or alliances, and very seldom prioritized a particular kin group. While offspring often oppose a marriage due to the age of a potential spouse, parents rarely cite this as a reason for disagreement, the only such case being one in which the parents did not want their son to marry an older woman.

Outcomes of disagreement

In ethnographies where parents and offspring disagreed over a potential spouse, arranged marriages occurred in 52 cases, non-arranged marriages (e.g., elopements or love marriages) occurred in 43 cases, and both types occurred in 40 cases (See Table 2.7). “No marriage” as a result of a disagreement was reported in 15 cases. The outcomes of a disagreement were unclear or unreported in 17 ethnographies.

Several actions were taken by offspring to avoid an arranged marriage they disliked, including running away (17 cases), committing or threatening to commit suicide (10 cases), or engaging in violence or fighting (8 cases). Another common strategy taken by offspring was to engage in premarital affairs, many of which resulted in pregnancy, as a way to force parents to allow marriage to a lover. In three cases, other people were recruited to be mediators to convince parents to allow a love match. These mediators included other residents of the village, matchmakers, and religious figures.

Table 2.5: Reasons offspring disagreed with their parents over the choice of spouse

Category	Reason for Disagreement	Count
	None given	66
Love	Loves a specific other person	62
	General desire for love/romance	11
Dislike Parents' choice	General dislike of parents' choice	13
	Avoid age gap (parents' choice too old or young)	12
	General personality/compatibility issues	9
	Parents' choice has physical disability	4
	Finds parent's choice unattractive/wants someone attractive	4
	Wants someone educated	2
	Wants to avoid differences in intelligence	1
	Parents' choice has "wrong" occupation	1
	Parents' choice commits domestic violence	1
Offspring reject a societal rule or expectation	Wants different ethnicity/religion/caste	2
	Wants to avoid marrying close kin	2
	Wants to marry close kin	2
	Wants to marry someone of "wrong" kinship class	2
	Wants a larger mate pool	2
	Wants to marry into outgroup (to increase status)	1
Other circumstances	Does not want to marry yet	3
	Sexual issues/shyness about sex	2
	Wants to avoid polygyny	2
	Wants to be a monk	1

Data comes from 175 ethnographies coded as "disagreement". An ethnography could contain multiple reasons for disagreement.

Table 2.6: Reasons parents disagreed with their offspring over the choice of spouse

Category	Reason for Disagreement	Count
	None given	92
Economic Benefits	Want benefits from marital transactions	20
	Want property/access to property	4
	Want economic benefits for offspring	2
Social Benefits	Want a spouse from an acceptable kin category	18
	Want to build/reinforce alliances	17
	Want to enhance reputation/status/political standing	12
	Foster reciprocity/exchange/social relationships	10
	Want good family background	9
	Want marriage within same ethnicity/religion/caste	7
Dislike Offspring's Choice	Want someone educated	1
	Want particular personality traits	1
	Avoid age gap (son wanted to marry older woman)	1
	General unacceptability of a suitor	1
Household Labor	Want someone to care for them/be a housekeeper	5
	Offspring is a burden on the parents	2
Other Circumstances	Do not trust offspring to make decisions/judge character	2
	Prefer a different marriage age/timing for offspring	2
	Want offspring to avoid military service	1
	Want to avoid bad omen	1

Data comes from 175 ethnographies coded as "disagreement". An ethnography could contain multiple reasons for disagreement.

Outcomes of non-arranged marriages were usually not reported, particularly long-term outcomes. However, fifteen cases reported parents accepting a non-arranged marriage only following a payment (e.g., bridewealth). In 12 cases parents withheld property, money, or kinship status from children who insisted on a non-arranged marriage, or from the grandchildren resulting from non-arranged marriages. One ethnography also noted that the siblings of those who had non-arranged marriage may have their own marriage prospects negatively affected. Only one ethnography explicitly reported that a non-arranged marriage resulted in a long-term happy marriage.

The outcomes of arranged marriages were much more frequently reported. Divorce was reported in 33 cases, and adultery was reported in 12 cases. Following divorces, remarriages were also common (12 cases), 8 of which were non-arranged. Ethnographers pointed out unhappiness or incompatibility in arranged marriages in 10 cases, but also described happiness and compatibility in 5 cases. Ethnographers also described fertility problems (5 cases) and refusal of sexual relations with an arranged spouse (3 cases).

In our coding of these outcomes, we also noted that 17 ethnographies explicitly stated that there was a cultural shift away from arranged marriage and/or that arranged marriages were not continued in subsequent generations. While this is not technically an outcome of disagreement (nor was it a sufficient pattern to code a paragraph as disagreement in the first place), it suggests a consistent direction of cultural change.

Table 2.7: Outcomes of disagreements over spouse choice between parents and offspring

No information on outcome		17
Type of marriage	Non-arranged (elopements and love marriages)	43
	Arranged	52
	Both (arranged and non-arranged)	40
	No marriage	15
Action to avoid marriage	Run away	17
	Commit or threaten suicide	10
	Premarital sex (sometimes producing pregnancy)	11
	Violence or fighting	8
	Use of mediator to convince parents	3
	Offspring joins monastery	2
	Break off engagement by paying other family	1
Results of non-arranged marriage	Child (or grandchild) cut off from property, money, or kin	12
	Parents accept marriage after receiving payment	15
	Couple happy/compatible	1
	Siblings of eloping couple have worse marriage prospects	1
Results of arranged marriage	Divorce	33
	Remarriage (arranged)	2
	Remarriage (non-arranged)	8
	Remarriage (unspecified type)	2
	Adultery	12
	Fertility problems	5
	Couple not happy/not compatible	10
	Couple happy/compatible	5
	Refuse sex with arranged spouse	3
	“become demented”	1
	Rape	1
	Infanticide	1
Other Information	Arranged marriage less common in next generation (mainly due to cultural changes)	17

A single ethnography can be counted multiple times if it reported multiple outcomes.

2.D. Discussion

Based on a comprehensive world-wide sample (HRAF ethnographies), parents and offspring are much more likely to disagree than agree over spouse choice in arranged-marriage contexts. Our results suggest that arranged marriage plausibly subverts evolved

mating preferences and thus may be a useful probe to investigate the potential reproductive benefits of mating preferences in humans (or alternatively, the strategies parents might use to mitigate fitness costs to acquiescent offspring).

This logic is supported by experimental-pairing studies in non-human animals which reveal rather consistent fitness costs when mating preferences are inhibited. Thus, it is interesting that, on current evidence, arranged marriage in humans does not measurably reduce fitness (at least in terms of number of offspring or timing of births), despite ample evidence of disagreement over partner choice between parents and offspring. One explanation for this counter-theoretical result may be that arranged marriage does not provide a useful analogy for the experimental animal studies because, in humans, both parents and offspring are exhibiting choice and, in cases where both parties compromise, mates might have qualities that both desire. The few existing human studies use arranged and non-arranged marriage as dichotomous categories, which may not be representative of actual spouse-choice decisions (Shenk 2017). We found several cases in the HRAF demonstrating negotiation and compromise between parents and offspring. We would expect to see different fitness outcomes between those who had no input regarding their spouse (i.e., completely arranged marriages), those who compromised with their parents over spouse choice, and those who chose their spouse with no parental input (e.g., elopements). Thus, future ethnographic work on this topic should probably treat "mode of mate choice" as an ordinal variable with several categories between fully arranged and fully governed by offspring preferences.

Moreover, the human situation may be more complex if the fitness effects of parental influence over spouse choice vary by offspring sex. One finding that emerges from the

Standard Cross-Cultural Sample (Broude and Greene 1984) and other tabulations (Apostolou 2007, 2010b, 2012), rather than from our analysis of the HRAF sample, is that parents more often control the marriages of their daughters than of their sons. With respect to sons 46 of 157 cultures (29.3%) normatively practice arranged marriage, whereas for daughters 71 of 161 cultures (44.1%) normatively do so, a highly significant difference (p=0.007 by Fisher's Exact Test), and the difference remains even when separated into foraging societies (Apostolou 2007), agropastoral societies (Apostolou 2010b), and historical societies (Apostolou 2012).

This sex difference in parental control may illuminate parental strategies. In humans, as in most other mammals, there is higher variance in male than female reproductive success (Trivers and Willard 1973, Betzig 2012) with the most successful males having higher reproductive success than the most successful females, and the least successful females having higher reproductive success than the least successful males. Given this difference in variance it may be less advantageous for parents to constrain their son's mating strategies and less harmful to constrain their daughter's. More specifically and adaptively, it makes sense to ask separately, in what directions parents are trying to move son's and daughter's marriage options; thus future analyses of the fitness effects of spouse choice should analyze the sexes separately. Another factor to consider in such analyses is the extent to which women's typically younger age at marriage results in their having less negotiating power (Apostolou 2007, 2010a; Shenk 2017).

In order for parent-offspring disagreement to have no fitness consequences, parents and offspring would need to disagree over reproductively irrelevant qualities, indicating that the disagreement is not true parent-offspring conflict (*sensu* Trivers 1974). It is possible that

offspring disagree over issues such as general autonomy rather than the specific traits in a partner. If this were the case, we would expect to see no cross-cultural consistency in the traits that produce disagreement. While this is possible, it is unlikely since existing research consistently shows that, compared to their parents, unmarried adults generally prioritize traits such as physical attractiveness (a potential sign of genetic quality) in a variety of cultures (Apostolou 2015; Bovet et al. 2018; Buunk and Castro Solano 2010; Buunk, Park, and Dubbs 2008; Dubbs and Buunk 2010; Hynie, Lalonde, and Lee 2006; Perilloux et al. 2011).

Our tabulation of the reasons for disagreement of both parents and offspring substantially reinforces these previous findings. Offspring give more weight to the physical characteristics of potential spouses than do parents, including attractiveness of a potential spouse and the absence of physical disabilities, both of which may signal health or genetic quality and thus may affect reproductive outcomes. By far the dominant category of disagreement concerned the offspring's insistence on being in love with their future spouse (and the parents' complete neglect of this requirement). While a comprehensive review of the relevant literatures would subsume many volumes, there is plausible reason to expect that this emotion evolved to recognize and promote fitness-enhancing mateships (Kenrick 2006; Lieberman and Hatfield 2006). For example, in the Hadza, spousal love (specifically, commitment and passion) seems to increase number of children (Sorokowski et al. 2017b).

Consistent with the results of previous surveys, our sample shows that parents emphasize the importance of appropriate kinship, ethnicity, and religious background than do offspring. This may work in conjunction with the parents' preference to arrange marriages to forge alliances and reciprocal relationships, which could be facilitated by similar cultural backgrounds. These priorities may indicate that parents are focused not just on the quality-of-

life or personal fitness of the marrying child, but also on the social and economic interests (and inclusive fitness) of the entire family.

2.D.i. Outcomes of disagreement

The frequency of arranged and non-arranged marriages occurring following a disagreement over spouse choice is quite similar, indicating that parents and offspring are both able to exert influence. Both types of marriages are often reported within a given ethnography (n=40). Offspring responses to undesired arranged marriages are sometimes extreme, including suicide elopement, and premarital pregnancy. Offspring are willing to risk exclusion from the kin group, and loss of resources critical to subsistence—threats often carried out by parents whose wishes are spurned.

What potentially fitness-enhancing avenues are the different parties pursuing to achieve their desired marriages, and why might those divergent strategies be beneficial for each of the actors?

2.D.ii. Offspring Strategies

If disagreements were over general autonomy (rather than manifesting Triversian parent-offspring conflict), we would likewise expect no pattern to offspring's resistance, and in particular no clustering of resistant tactics around reproductively relevant behaviors such as premarital or extramarital affairs. In our sample, offspring (including both men and women) engaged in pre-marital affairs in 11 cases and extramarital affairs in 12 cases, suggesting systematic parent-offspring disagreement over the reproductively relevant qualities of the mate.

For example:

> "Although lovers sometimes want to marry, the rules of arranged marriage make this difficult and most affairs—premarital or extramarital—are brief and casual, characterized by secret meetings, secret messages, and secret rendezvous for sexual intercourse."… "Request marriages are considered ideal, but sometimes a young person's dislike for the selected spouse or emotional attachment to someone else can lead either to the disruption of an arranged match or to the establishment of a marriage contrary to the wishes of the elders. Young people can force the issue by a 'running away marriage'." Caughey (1977, 113-19) writing about the Chuuk.

And

> "Marriage was traditionally arranged by the parents of young people. Love matches and elopements were not unknown, but marriage was, for the most part, a carefully arranged alliance between families ... Today, as in the past, a girl will sometimes get pregnant so that her parents will be forced to agree to a marriage." Gilliland (1986, 232-33) writing about the Croats.

Moreover, detailed paternity studies among the Himba show an informative pattern, with *all* cases of extra-marital paternity occurring in arranged marriages (Scelza 2011). Similarly, in our HRAF tabulations the reproduction-related outcomes of divorce, adultery, and infertility were noted in 33, 12, and 5 instances of arranged marriage and in *no* instances of arranged marriage. These patterns suggest that parent-offspring disagreement over mate choice in arranged marriage is plausibly fitness-relevant.

Our search returned other examples of strong offspring resistance to arranged marriage. Suicide, or the threat of suicide, was a possibility for offspring who wished to refuse an arranged marriage. Suicide was mentioned in 10 ethnographies in our results, all of which were coded as “disagreement”. For example:

> "[U]pon the suicide of a youth of 19 in 1954, public opinion strongly condemned the boy's parents for causing his death, reportedly because they had opposed a marriage he desired." Smithson (1959, 89) writing about the Havasupai.

And

> “Both boys and girls usually have personal preferences, and a girl faced with the prospect of unyielding parents and an undesirable match may threaten to commit suicide in order to force her parents to relent.” Starr (1978, 71) writing about the Turks.

Consistent with our results, Syme and colleagues (2016) also found that suicide over parent-offspring disagreement in spouse choice decisions is common in the HRAF.

Offspring also risked violent retaliation if they refused a marriage or eloped, and such violence or fighting was reported in eight ethnographies. For instance:

> "The last type of marriage, Type E, is one arranged by the bride and groom themselves, who defy custom and contract and elope! This happened occasionally in the past, but rarely had any great effect on the ultimate marriage exchange system, for the elopers were usually pursued by the offended contract makers, who often killed the groom or even both parties." Goodale (1971, 57) writing about the Tiwi.

If arranged marriage were a strategy for producing the most beneficial outcome for both parents and offspring, it would be nonsensical to employ tactics with such high potential fitness consequences.

2.D.iii. Parental Strategies

If parents can benefit by constraining their offspring's mate choice, what tactics might they use to achieve their objectives? One significant source of parental leverage, given their asymmetrical social, political, and financial power, is that parents could restrict the flow of various fitness-relevant resources to offspring who disregard parental priorities and increase such flows to more acquiescent offspring. For example, satisfied parents could provide more access to (or earlier transfer of) the productive value of lands or herds, larger dowries or bride price, better residence opportunities, and more direct care of and investment in resulting grandchildren. Our data includes 12 cases where parental threats to withhold resources are used to encourage their children to accept arranged marriages, for example:

> "Marriage was by elopement, arranged by the young themselves, or by contract between families arranged by the parents. The parents preferred contract, but they did not always succeed in anticipating elopement. Their subsequent approval of elopement had to be won before a marriage was socially recognised and validated by gift exchange between the families of groom and of bride. There was very strong feeling that a person should marry in his or or [sic] her own class, chief's daughter to chief's son, doctor's daughter to doctor's son, priest's daughter to priest's son."…
> "There was a very healthy conflict between the generations on the point of marriage,

> and a ready possibility of a parent cutting off a son or a daughter, as the case might be, from an inheritance of privilege." Fortune (1932, 22) writing about the Omaha.

And

> "The feelings of the boy and girl were considered; many legends caution against forcing a marriage. However, parents considered it a sign of their child's love for them when a son or daughter married according to their wishes; leaving a spouse was considered an act of obedience to parents. Such a child achieved greater authority and rights to land than did a disobedient child." Smith (1983, 140) writing about the Belau.

In terms of their effects, such parental largess could both encourage offspring acquiescence to parental wishes and, importantly, potentially compensate acquiescent offspring for losses due to suboptimal partner choice. Thus, we should anticipate more severe parental control in societies with inherited material wealth. Future studies of the dynamics of arranged marriage should systematically assess the use and fitness consequences of this kind of parental leverage.

2.D.iv. Future Directions

Based on our results, arranged marriage may be an appropriate context in which to study the effect of mate choice on reproductive outcomes. However, studies attempting to do so should first establish parent-offspring disagreement in the demographic group of interest and attempt to identify the specific fitness-relevant traits that are producing disagreement. Such studies should also consider the outcomes of parent-offspring disagreements and examine parental influence over spouse choice as an ordinal variable, rather than a

dichotomous one, based on the amount of relative control each party had in spouse choice. Treating marriage as an ordinal variable may illuminate fitness benefits of a compromise in spouse choice, where both parents and offspring get a set of traits that they prefer. Furthermore, within a society those in arranged marriages and those in non-arranged marriages may differ in important characteristics, such as economic independence or status, that need to be addressed in order to accurately assess the fitness differentials attributable to marriage type. Thus, demographic context is essential to future research in this area.

Because prior research shows no differences in reproduction between arranged and non-arranged marriages, research should also focus on the reasons for those negative results. Shenk (2017) has explicitly noted that arranged marriages may offer benefits, such as additional resources or social support, that compensate for any fitness losses incurred by limited mate choice. As suggested by a reviewer there might be societal differences, plausibly resulting from modes of subsistence, that shape how much reproductively relevant benefits parents can provide. For example, with intensification of modes of production, wealth transfers from parents to offspring may more significantly increase offspring fertility. Several observations support this perspective. Betzig 2012 has shown that reproductive variance is lowest in hunting and gathering societies and increases as production intensification increases, suggesting that intensification is consolidating reproductively advantageous resources in fewer hands. As would be expected on this view, there are parallel differences in the frequency of arranged marriage, with such practices being more common in agricultural and pastoralist societies than among hunters and gatherers (Apostolou 2010b). However, if the compensatory-benefits explanation is generally correct, parents must at least sometimes provide more than lands and herds to their offspring because arranged marriage is also

practiced by 69.9% (Apostolou 2007) or 85% (Walker et al. 2011) of hunting and gathering societies. For example, parents arranging marriages in the Ju/'hoansi appear to choose partners that facilitate wider social networks (Weissner 2009), which may also offer compensatory benefits to those in arranged marriages.

2.D.v. Limitations

The sources provided by the HRAF are ethnographic in nature and not systematically designed to investigate arranged marriage, much less the rates or causes of parent-offspring agreement or disagreement about marriage partners. Thus they rarely provide quantitative measurements of the proportion of arranged marriages in the described society, and never provide numerical data on the frequencies of agreement and disagreement between parents and offspring in such contexts. Given this limitation we paid special attention to qualitative frequency assessments (i.e., never, rarely, often, etc.) in making our coding decisions. The texts also vary on whether they described individual marriage cases or general patterns across the society. When integrating multiple paragraphs from a given ethnography, single cases of disagreement (i.e., a story about a particular disagreement) were given less weight than descriptions of the typical pattern of agreement or disagreement in the culture. Even then, there were many ethnographies that had insufficient information to determine whether parents and offspring disagreed over spouse choice, often because the ethnographer did not write about the opinions of each party, and this omission may have affected our results.

Because all sources were qualitative accounts, they are open to reporting bias based on what each ethnographer observed and what they chose to describe (e.g., it may be more interesting to describe disagreement than agreement—although from a "Western"

perspective, passively agreeing to a mate not of one's choosing may also be a salient outcome). Different ethnographers may view the same culture in different ways at the same or different times. While it is impossible to determine the orientation of each of the 205 ethnographies in this analysis, they likely represent both emic and etic perspectives, which may also affect interpretation. The extent to which we are capturing an accurate picture of what actually transpired in these societies might be indicated when we collapse across ethnographies to get a single coding for each culture. If the ethnographies are overly subjective and unrepresentative of the facts on the ground, there should be many conflicting reports, but aggregation of our data to the level of the culture produced only 16 cultures (13.4%) where a consistent picture of agreement or disagreement was not painted by the ethnographers (Tables 2.3 and 2.4).

We appreciate that there are many nuanced questions one might ask about the milieu, roles, processes, and cultural significance of arranged marriage systems, and that the HRAF might well be unsuitable for some such investigations. However, to know whether arranged marriage provides a useful context for future studies of the possible benefits of free mate choice, we need to know only if parents and offspring are selecting the same mates. Our results suggest that, in a useful sample of cultures, the HRAF can provide such data and that, based on the level of ethnographer agreement, these data are reliable.

2.E. Conclusion

Our systematic cross-cultural study indicates that arranged marriage is associated with widespread, sometimes quite intense, disagreement between parents and offspring over partner choice, and thus could be an appropriate probe to investigate the fitness effects of

restricted mate choice in humans. While most cultures with arranged marriage exhibit parent-offspring disagreement over spouse choice, it should be noted that our results do not mean that every culture will be characterized by such disagreement. Therefore, studies that intend to use arranged marriage as a test of the fitness benefits of mate choice should first establish the presence of Triversian (fitness-relevant) disagreement over spouse choice in that particular culture.

At the same time, it is essential to recognize the strategic agency of parents. Researchers should strive to measure the extent to which parents provide compensatory benefits to offspring who do and do not accept the pairings they arrange. Such benefits could include use or ownership of real or movable property, hereditary social privilege, alliances with powerful or wealthy affines, and generalized social support. A full understanding of arranged marriage will detail the range of both parental and offspring priorities and strategies and will explain why these various tactics are so conspicuously restricted to humans.

2.F. References

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Chapter 3: Arranged and non-arranged marriages have similar reproductive outcomes in Nepal

Authored by:

Elizabeth Agey

3.A. Introduction

In humans and other animals, preferences for particular mates, in contrast to random mating, presumably evolved because they increase reproductive fitness in their bearers. However, despite the pervasiveness of studies on evolved mate preferences, there are comparatively few studies investigating the underlying assumption that selectivity in mate choice increases fitness, particularly in humans (but see Silva, Lummaa, Muller, Raymond, & Alvergne, 2012). This study will test whether constrained mate choice decreases reproductive success in humans. I use arranged marriages as a proxy for limited mate choice, and test whether arranged marriage leads to lower offspring survival and lower fertility via longer interbirth intervals in a rural Nepali population.

A number of experimental (non-human) animal studies have attempted to test whether the opportunity to exercise mate preferences increases reproductive success. In these studies, having the ability to choose a partner or being mated with a preferred partner is considered free mate choice, while being assigned a mate at random or being mated with a non-preferred partner is considered limited mate choice. As reviewed in Chapter 1, these animal studies show several fitness benefits to free mate choice for both males and females, including better offspring survival (Agbali, Reichard, Bryjová, Bryja, & Smith, 2010; Anderson, Kim, & Gowaty, 2007; Bluhm & Gowaty, 2004; Crocker & Day, 1987; Ihle, Kempenaers, & Forstmeier, 2015; Massa, Galanti, & Bottoni, 1996; Partridge, 1980; Sun, Zhou, Stone, Qiu-Hong, & Sheng-Guo, 2019), faster reproduction (Drickamer, Gowaty, & Wagner, 2003; Gleason, Holschbach, & Marler, 2012; Gowaty, Drickamer, & Schmid-Holmes, 2003; Simmons, 1987), improved offspring growth (Havens, Orzack, & Etges, 2011; Sandvik, Rosenqvist, & Berglund, 2000), and resistance to infection (Raveh et al., 2014). This

evidence supports the hypothesis that mate preferences increase fitness in animals. However, there have been fewer attempts to examine whether mate choice similarly increases fitness in humans.

Some human cultural practices may provide a useful proxy for the limited-mate-choice treatments in the animal literature. One such system is arranged marriage, an ethnographically common practice in which close relatives, usually parents, choose a marriage partner for their offspring (Apostolou, 2007; Shenk, 2017). These arranged marriages are distinct from forced marriages, as offspring may sometimes approve of arranged marriages. Arranged marriage is not a perfect analogy to the experimental animal studies because selection is not "random mating"—both arranged and non-arranged marriage involves partner choice, although by different parties. Despite this distinction, arranged marriage provides an opportunity to examine the effects of free mate choice on fitness because the interests of parents and their offspring often do not fully align. Parents can increase their fitness via aggregate grandchild production, while their offspring gain larger fitness benefits through their own reproduction than through their siblings' (Trivers, 1974). Thus, when parents arrange a marriage they may focus more on family-level benefits of the match, while their offspring should theoretically be more focused on traits that maximize their individual fitness. If parents and offspring express different preferences for fitness-relevant traits in an in-law or spouse, respectively, then arranged marriages and non-arranged marriages should have different fitness outcomes.

Copious ethnographic data suggest that parents and their offspring do not agree on preferred traits for an in-law or spouse. As reviewed in Chapter 2, a comprehensive survey of the Human Relations Area Files found that parents and offspring show disagreement over

spouse choice in 85.4% of ethnographies analyzed, and this pattern was consistent in every world area (Agey, Morris, Chandy, & Gaulin, 2021). Several studies, including in arranged-marriage cultures, show that people place more value on physical attractiveness in a spouse (a potential indicator of genetic quality or compatibility) than do their parents (Apostolou, 2011, 2014; Bovet, Raiber, Ren, Wang, & Seabright, 2018; Buunk, Park, & Dubbs, 2008; Dubbs, Buunk, & Taniguchi, 2013; Perilloux, Fleischman, & Buss, 2011). Conversely, parents in these studies seem to place more weight on similar cultural and religious backgrounds than do their children. Similar backgrounds support the building and strengthening of social ties, which would benefit the marrying offspring's siblings and other family members and would thus be more important to parents than to each of their offspring individually (Apostolou, 2008). Parent-offspring disagreement may also exist over marriage timing (Apostolou, 2010), and offspring may desire later marriages to have more power to choose a mate or to avoid early reproduction. While there is also much overlap in fitness interests between parents and offspring, the traits that appear to produce disagreement are reproductively relevant. Thus, arranged marriage can be examined as an indicator of the fitness effects of free versus constrained mate choice.

Despite ample cross-cultural evidence of parent-offspring disagreement over the qualities of a potential spouse, it is still unclear whether these disagreements have fitness consequences. If humans follow the same pattern as the experimental animal studies, then arranged marriages can be expected to lower fitness. However, previous work has not found any differences in number of surviving or number of deceased offspring between those in arranged and non-arranged marriages across or within three societies, the Yali, Tsimane, and Bhotiya (Sorokowski, Groyecka, et al., 2017). Another study found that arranged couples in

Indonesia had slightly fewer live births, but there were no differences in other fitness measures indicative of offspring growth, such as birth weight, or parental investment, measured by breastfeeding duration (Hasnain, 2020). Thus, these studies, which rely on dichotomous measures of marriage type and include limited demographic information, provide mixed evidence on whether humans show the predicted relationship between free mate choice and higher reproductive success. If humans do not follow this pattern, then humans may be utilizing alternative fitness strategies that mitigate the costs of constrained mate choice.

While it is important to test the connection between mate choice and fitness for theoretical reasons, the connection between arranged marriages and reproductive outcomes is also important for public health. Arranged marriages are sometimes listed as a concern by NGO and non-profit organizations as a harmful practice because it is assumed to have poor outcomes for women and children. If arranged marriages have poorer offspring survival than self-chosen marriages after accounting for demographic differences between individuals, then these results could support those causes. Alternatively, if there are no differences in outcomes like offspring survival, then it might indicate that these practices are less harmful than assumed, and that resources could be allocated to different intervention programs.

This study compares offspring survival and interbirth intervals between women in arranged and non-arranged marriages to assess whether humans experience fitness benefits from choosing their own mates. To examine these outcomes, I analyzed data from the Chitwan Valley Family Study of Nepal (CVFS) (Axinn et al., 2022). Because Nepal has been shifting from a tradition of arranged marriages to a system of non-arranged marriages (Ghimire, Axinn, Yabiku, & Thornton, 2006), these data include useful variation in marriage

type in a large representative sample with rich demographic information, which can be used to control for confounding demographic differences between the types of people who end up in different types of marriages. Nepal also has a very low rate of divorce and remarriage (*Nepal Population and Housing Census 2011*, 2012), making spouse choice an effectively permanent decision that is more likely to have detectable long-term fitness consequences. Using data from approximately 1,200 women in the CVFS, I examine three fitness outcomes that are improved by free mate choice in experimental animal studies or in previous studies testing the association between arranged marriage and fitness: total births, offspring survival, and interbirth intervals. If expression of mate preferences increases fitness, as demonstrated in the non-human literature, then I hypothesize that:

(Analysis Set 1) women in arranged marriages will have fewer total births,

(Analysis Set 2) women in arranged marriages will have lower offspring survival,

(Analysis Set 3) women in arranged marriages will have longer interbirth intervals (i.e., a slower rate of reproduction).

To foreshadow the result, these analyses will show that arranged and non-arranged marriages have similar fitness outcomes and do not fit the predictions derived from animal experiments. Because these results are similar to previous human studies (Hasnain, 2020; Sorokowski, Groyecka, et al., 2017), this pattern of results may indicate that humans experience less parent-offspring conflict than expected and/or that arranged marriages offer as yet unspecified benefits that compensate for any fitness lost by not choosing a spouse independently. For these reasons, human marriage practices may maximize fitness via different pathways than the mate-choice systems of other animals.

3.B. Methods

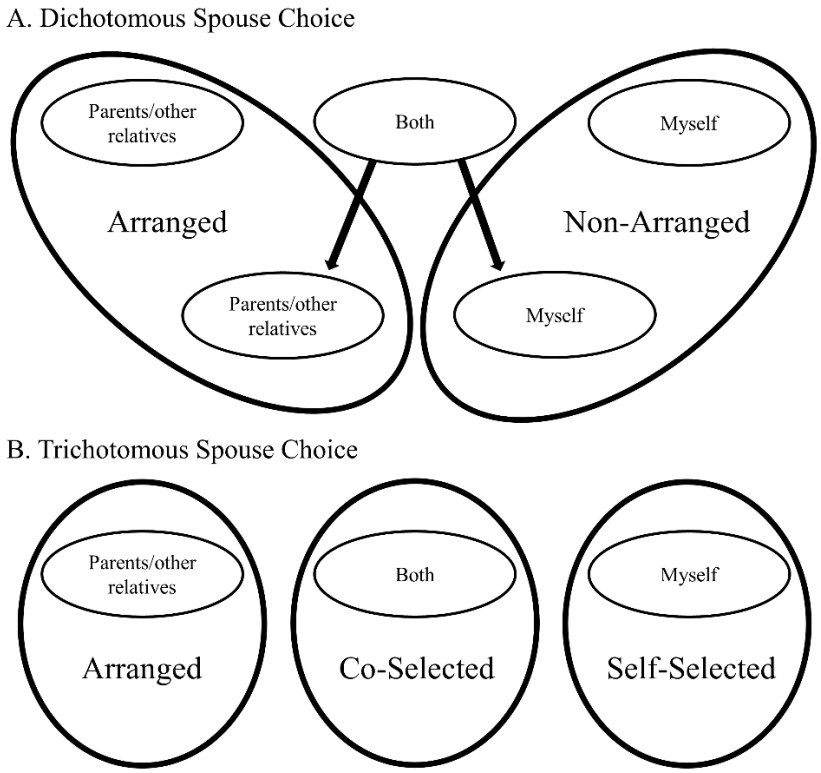
3.B.i. Data

The CVFS is directed and maintained by Axinn et al. (2022) at the University of Michigan. The data in this analysis were collected via individual interviews in 2008, in which all men and women aged 15-34 and their parents in 151 sample neighborhoods were surveyed. The sample neighborhoods represent a spread of rural and urban communities (ranging .02-17.7 miles from the nearest city, mean=8.24, SD=3.93). The data set also includes migrants who have moved away from sample neighborhoods for work, but who still have spouses or children in the sample neighborhoods. Thus, the data are highly representative of the sampled communities. In Nepal, during the period these data were collected, the total fertility rate was 2.7 and the infant mortality rate was 40 per 1000 births (World Bank, 2023) The following analyses limited this sample to women who were ever married and who completed both the individual interviews and the life history calendar (n=1,544). The CVFS data are available upon request via the Inter-University Consortium for Political and Social Research (ICPSR).

Marriage type: Responses to the question "Who primarily was responsible for choosing your spouse?" were used to determine marriage type for each respondent. Respondents were prompted to choose "Parents/other relatives", "Myself", or "Both" as responses. If they answered "Both", they were asked again to choose whether their parents or themselves had more influence. Marriage type was categorized as non-arranged if the respondent answered "Myself" in either the first or second round of questioning. Marriage type was categorized as arranged if the respondent answered "Parents/other relatives" in the first or second round of questioning. Respondents who maintained that both themselves and

their parents were equally responsible for choosing their spouse following the second round of this question (n=49) were excluded from the analyses using dichotomous spouse choice. To determine whether our results were simply a result of dichotomous categorization, which does not accurately capture the range of ethnographic descriptions of spouse choice methods, analyses were also run using three categories of marriage types based on the respondents' first responses, meaning those who responded "Both" were kept in a separate category, hereafter called co-selected marriages. Figure 3.1 depicts this coding scheme.

Figure 3.1: Marriage type coding schemes
Based on responses to the question "Who primarily was responsible for choosing your spouse?". Dichotomous choice is used in models 1a-b, 2a-b, and 3a-b and trichotomous choice is used in models 1c, 2c, and 3c-d.



Fitness variables: Total number of births, number and timing of offspring deaths, and the timing of each birth were derived from life history calendars of the respondents. Life

history calendars were also used to calculate each respondent's age, birth year, and age at first marriage, which were used as controls in several models. The total years on birth control were also calculated from life history calendars. However, I do not include birth control in the models reported in this paper because contraceptive use is a method through which women in different marriage types could produce the differences in fitness outcomes that we are interested in. The life history calendars incorporated community and national events to improve recall among respondents who do not know exact dates or ages (Axinn, Pearce, & Ghimire, 1999).

Socioeconomic variables: Because arranged marriages may be associated with certain demographic characteristics that could confound any effect of marriage type, like income and education, I controlled for additional socioeconomic factors. Education was determined by the respondent's self-reported highest level of education completed. This was either listed as the highest grade level completed, or the highest degree obtained. Degrees obtained were converted to a year measure based on the typical number of years it takes to complete each degree type (e.g. a School Leaving Certificate would be 10 years, A-levels would be 12 years, and a Bachelor's Degree would be 16 years). Annual household income level contains seven categories specified in Nepalese Rupees (<10,000 [under $100], 10-25,000, 25-50,000, 50-100,000, 100-250,000, 250-500,000, and >500,000 [above $4,000]). Interviewers began by asking whether household income was higher or lower than 50,000 Rupees (about $400 USD), and then asking the same for each subsequent category until the range of the household income was determined. Income data were not collected for individuals and was not available for every household in the data set. Individuals without household income data,

who were distributed across marriage types but tended to be younger with fewer births, were excluded from all analyses (n=246).

3.B.ii. Descriptive statistics

Descriptive statistics for each of the three marriage types are presented in Table 3.1. In total, 36.9% of marriages were arranged by parents or relatives in this sample, 39.6% of marriages were self-selected, and 23.5% were co-selected by parents and offspring. In the 1,298 women included in analyses, 78.7% are over age 35 and 43.2% are over age 45, indicating that a substantial proportion of women in the analyses have completed reproduction. Respondents who chose their own spouse tended to be younger at the time of data collection (means: arranged=47.3, co-selected=39.0, and self-selected=38.8). This likely indicates a secular change in marriage practices, with movement away from arranged marriages and toward non-arranged marriages. Those who co-selected a spouse with their parents had higher mean levels of education (means: arranged=5.5 years, co-selected=8.1 years, self-selected=5.7 years). Women in arranged and co-selected marriages had slightly higher income levels (means: arranged=3.3, co-selected=3.4, self-selected=3.1). Women in arranged marriages tended to marry at younger ages than those in non-arranged marriages (means: arranged=20.1 years, co-selected=22.5 years, self-selected=21.6 years). Those in arranged marriages tended to have more children on average (means: arranged=4.1 children, co-selected=2.6 children, self-selected=3.0 children). Women in arranged marriages used birth control for fewer years on average (means: arranged=2.4, co-selected=3.5, self-selected=3.1). Of the respondents who said they jointly chose their spouse with their parents (i.e., co-selected spouses), 42.6% subsequently said their parents had more influence, while

41.5% said they had more influence themselves. Summary statistics for the dichotomous marriage type categories are available in the appendix, Table 7.1.

Table 3.1: Mean and standard deviation for demographic characteristics by marriage type for married women in the CVFS

	Arranged (n=479)		Co-Selected (n=305)		Self-Selected (n=514)	
	Mean	SD	Mean	SD	Mean	SD
Age	47.3[ab]	9.6	39.0[a]	9.7	38.8[b]	10.8
Age at Marriage	20.1[ab]	4.7	22.5[ac]	4.1	21.6[bc]	3.9
Marriage Year*	1982[ab]	11.4	1993[a]	10.7	1991[b]	10.8
Age at First Birth	23.9[a]	4.9	24.6[b]	4.0	23.9[b]	4.2
Total Children	4.1[ab]	2.3	2.6[ac]	1.5	3.0[bc]	2.1
Total Surviving Children	3.7[ab]	1.9	2.4[ac]	1.3	2.7[bc]	1.8
Total Years on Birth Control	2.4[ab]	4.1	3.5[b]	4.4	3.1[a]	4.1
Years Attended School	5.5[a]	4.4	8.1[ab]	4.3	5.7[b]	4.4
Hh. Income Level**	3.3[a]	1.4	3.4[b]	1.4	3.1[b]	1.3

Shared superscripts indicate significant differences ($p<.05$) across each row.
*Marriage years are converted to Gregorian calendar years by subtracting 56 from the Nepali calendar years used in the CVFS. Nepali calendar year means are 2038 (Arranged), 2049 (Co-Selected), and 2047 (Seld-Selected).
**Household income level: Ordinal categories ranging from 1-7, see above "Data" section in the methods for the corresponding categories.

In addition to these demographic summary statistics, we also examined patterns of love and marital disagreement across marriage types. Women in arranged, co-selected, and self-selected marriages experienced similar levels of love and marital disagreements (Tables 3.2 and 3.3).

Table 3.2: Responses to the question "How much do you love your spouse" for the married women included in subsequent analyses

Marriage Type	Very Much	Some	A little or Not at all	Total
Arranged	137 (25%)	312 (57%)	98 (18%)	547
Self-Selected	183 (30%)	331 (54%)	103 (17%)	617
Co-Selected	100 (29%)	193 (56%)	53 (15%)	346

Overall differences: $\chi^2=4.21$, $p=.65$

Table 3.3: Responses to the question "How frequently do you and your spouse disagree?" for the married women included in subsequent analyses.

	Frequently or Sometimes	Seldom	Never	Total
Arranged	67 (12%)	331 (61%)	148 (27%)	546
Self-Selected	110 (18%)	368 (60%)	140 (23%)	618
Co-Selected	40 (12%)	211 (61%)	95 (27%)	346

Overall differences: χ^2=14.92, p=.02

3.B.iii. Analysis

All data analysis was done using R (R Core Team, 2022). Variance Inflation Factors for each model were calculated to check for collinearity (the max VIF in any model was 1.28).

For Analysis Set 1, I examined the relationship between marriage type and the count of total births using Poisson generalized linear models. Analysis 1a predicts total number of births for women as a function of age, household income, education, age at first marriage, and dichotomous marriage type to allow for comparison to previous studies (Hasnain, 2020; Sorokowski, Groyecka, et al., 2017). Model 1b expands 1a by using the same controls with the trichotomous grouping of marriage types.

Analysis Set 2 examines the relationship between marriage type and offspring survival to age 15. These analyses used discrete time survival analysis (Singer & Willett, 2003). All models include covariates for time, mother's age at the time of the birth, birth year, mother's education, and household income level. Similar to Analysis Set 1, I ran a model with dichotomous spouse choice (2a) and one with trichotomous spouse choice (2b).

In Analysis Set 3, I examined whether marriage type affected the rate at which individuals have children. To examine first-birth interval (Analysis 3a) and second-birth interval (Analysis 3b), I used discrete-time survival analysis (Singer & Willett, 2003). For

these analyses, our period of observation was the first nine years following their marriage (first-birth interval) or nine years following the first birth (second-birth interval), at which time 95% of women had experienced a birth event. Time and time squared were included in all analyses to better represent the non-linearity in the raw data, and controls for age, age at marriage, education, and household income were included. The first- and second-birth-interval models were also run with trichotomous marriage type (Models 3c and 3d).

3.C. Results

3.C.i. Fitness Outcomes

The results of models 1a and 1b are described in Table 3.4 and Figure 3.2. Type of marriage, whether arranged or non-arranged, had no effect on number of births. Household income also had no effect. As expected, respondent's age had a positive effect on number of births. Likewise, higher education level and older age at first marriage was associated with fewer total births, again probably due to having fewer children overall. These results did not change when running the analyses with three marriage categories rather than two (Analysis 1b).

Offspring survival to age 15, modeled using survival analysis, did not show any differences between marriage types in either the dichotomous or trichotomous choice. Figure 3.3 shows the predicted hazards (risk of offspring death) and survival curves (probability of surviving to each age) by marriage type. Again, the dichotomous and trichotomous spouse choice models did not show any differences in results.

Figure 3.2: Plotted results of models 1a (dichotomous choice) and 1b (trichotomous choice), variables affecting number of births.

Coefficients are converted to prevalence ratios and the bars represent 95% confidence intervals. Reference spouse choice group for all models is arranged marriage. For more detail, see Table 3.4.

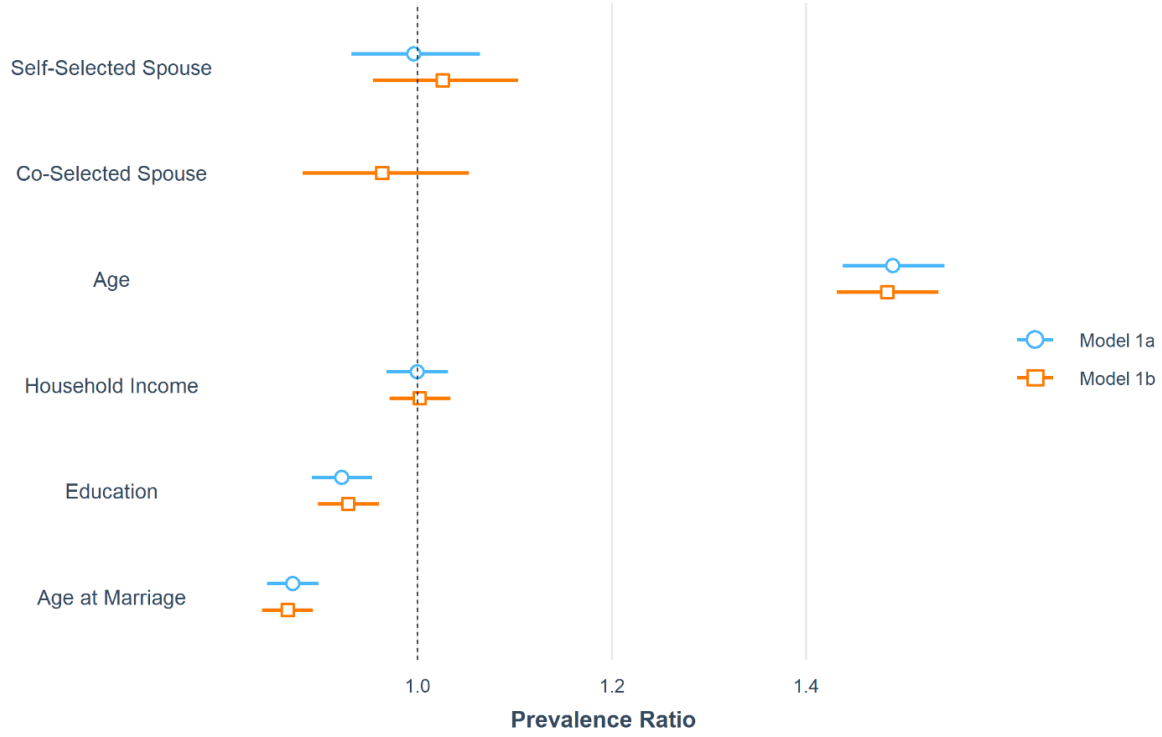
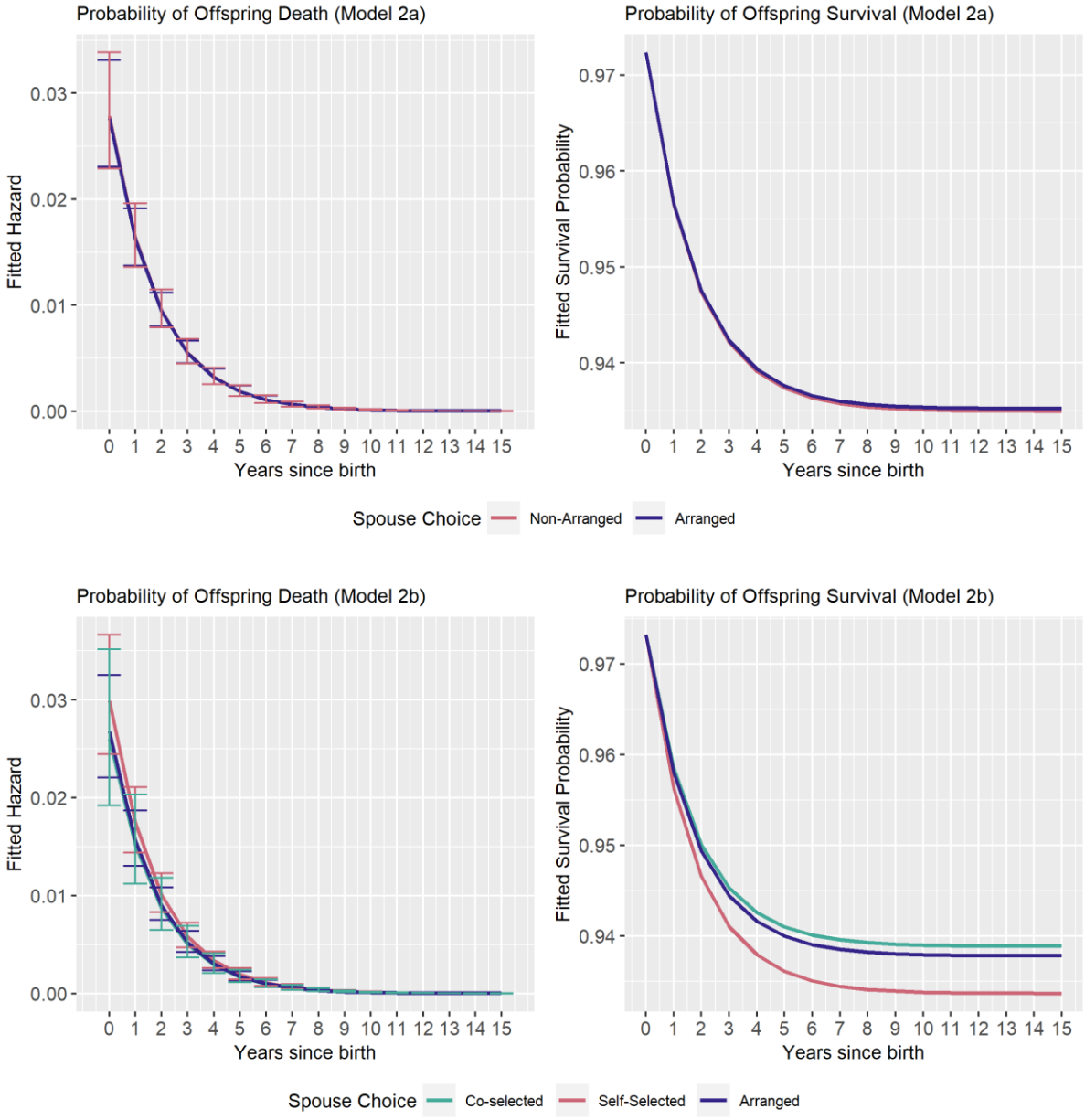


Table 3.4: Results of models 1a and 1b
Coefficients are converted to rate ratios and standard errors are in parentheses. Reference spouse choice group for all models is arranged marriage (parentally selected).

	Dependent variable:	
	Total Children	
	Model 1a	Model 1b
Self-Selected Spouse	0.996	1.026
	(1.034)	(1.038)
Co-Selected Spouse		0.964
		(1.046)
Age	1.037***	1.037***
	(1.002)	(1.002)
Household Income Level	1.000	1.002
	(1.012)	(1.012)
Years in School	0.982***	0.984***
	(1.004)	(1.004)
Age at Marriage	0.969***	0.968***
	(1.004)	(1.004)
Intercept	1.440***	1.434***
	(1.120)	(1.123)
Observations	1,249	1,298
Log Likelihood	-2,210.443	-2,294.311
Akaike Inf. Crit.	4,432.885	4,602.621
Note:		***p<0.01

Figure 3.3: Fitted hazards and survival probabilities from models 2a (dichotomous choice) and 2b (trichotomous choice), measuring offspring survival to age 15.

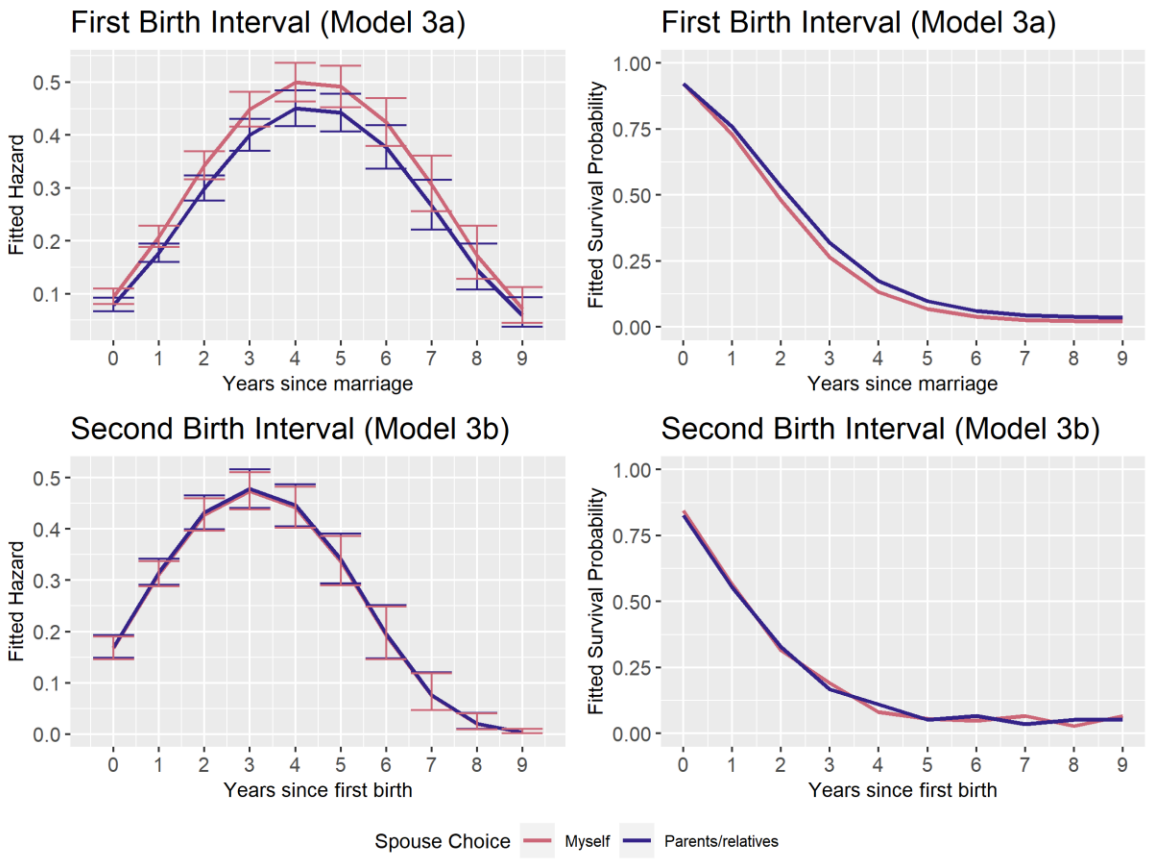


Error bars represent 95% confidence intervals. All models are adjusted for mother's age at the time of the birth, birth year, mother's education, and household income level.

Interbirth intervals were also investigated to see if there were differences in timing of reproduction between those in arranged and non-arranged marriages. Based on the predicted survival curves and hazards, there are no significant differences in first birth interval or

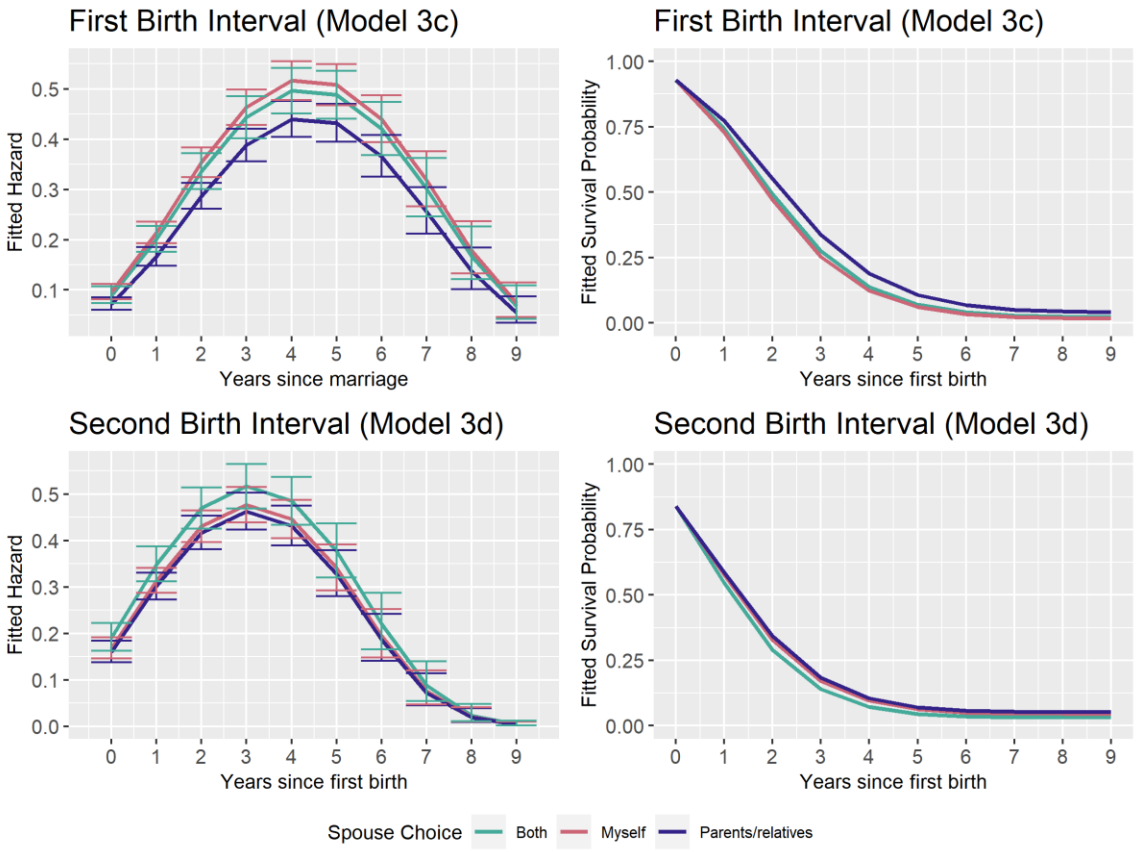
second birth interval between those in non-arranged and arranged marriages (Figure 3.4). Running this analysis with three marriage categories also did not show any significant differences in first birth interval or second birth interval by marriage type (Figure 3.5).

Figure 3.4: Fitted hazards and survival probabilities from models 3a and 3b, measuring first and second birth interval, respectively, using dichotomous spouse choice.



Error bars represent 95% confidence intervals. All models adjusted for age, age at marriage, education, and household income.

Figure 3.5: Fitted hazards and survival probabilities from models 3c and 3d, measuring first and second birth intervals, respectively, using trichotomous spouse choice.



Error bars represent 95% confidence intervals. All models adjusted for age, age at marriage, education, and household income.

3.C.ii. Parent-Offspring Disagreement in the CVFS

To help interpret the above results, I tabulated the level of parent-offspring disagreement across the sampled communities, although it was not possible to assess parent-offspring disagreement for the sample of currently married women analyzed above. The CVFS asks a small set of questions that can be used to estimate the level of parent-offspring disagreement between unmarried men and women and their parents. Respondents were asked to choose the first and second most important traits in a spouse for themselves or for their child, respectively. Respondents were given a list of four qualities: physical beauty, good

education, high paying job, and someone you (your son/daughter) love(s). Based on a simple tally of these data, both parents and offspring overwhelmingly prefer good education (offspring=52.2%, parents=54.3%) and high paying jobs (offspring=28.6%, parents=29.3%) as the most important trait in a potential spouse/in-law, indicating some overall agreement (see Table 3.5).

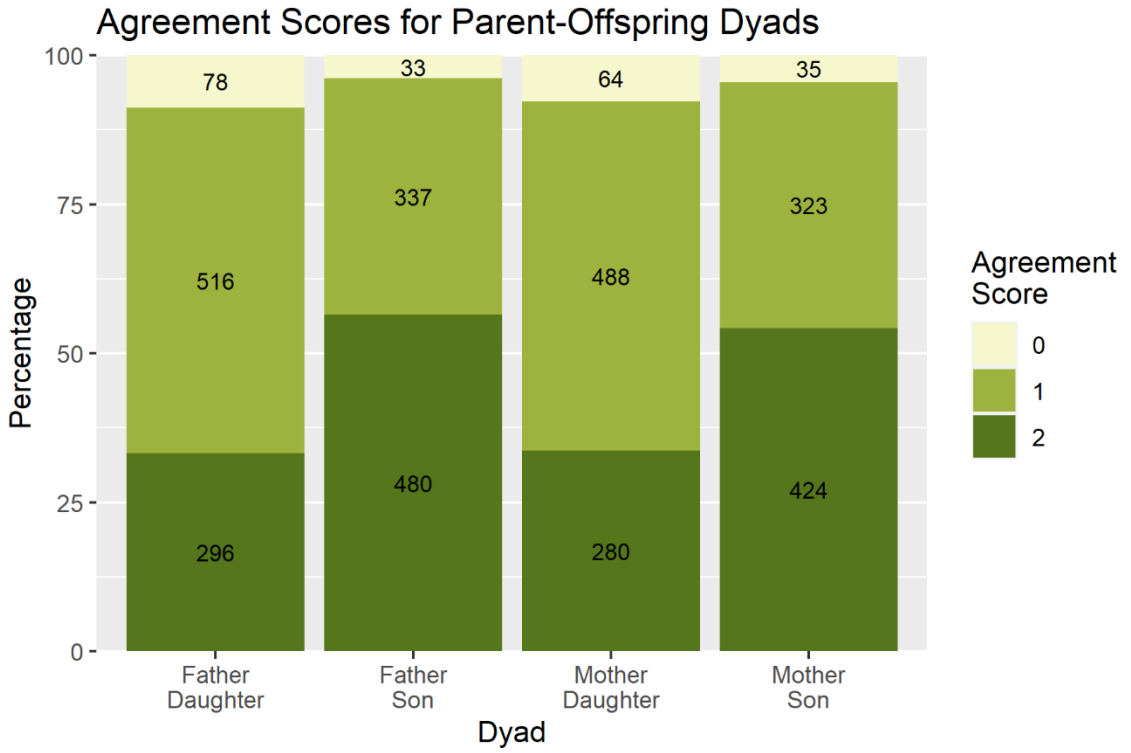
To further investigate, I calculated an Agreement Index for 3,307 parent-offspring dyads, which counts whether a dyad agrees on 0, 1, or 2 of their top two preferred qualities (from the same list of qualities above). Sorting by sex (See Figure 3.6), Mother-Son and Father-Son dyads agree on the top two qualities 54% of the time and 57% of the time, respectively. Mother-Daughter and Father-Daughter dyads agree on the top two traits 34% of the time and 33% of the time, respectively. Complete disagreement (i.e., an Agreement Index of 0) was uncommon across all types of dyads (Range: 3.9% to 8.8%), indicating that there is generally some amount of parent-offspring agreement. There was also hardly any disagreement over ideal marriage age within the 3,307 parent-offspring dyads, with 52% of parents and offspring perfectly agreeing on marriage age and 80% of dyads differing in their opinions by less than one year of age (Figure 3.7). As with the agreement index, parent-daughter marriage age preferences diverged more than parent-son marriage age preferences. This might indicate that more disagreement could be produced when daughters are marrying than when sons are marrying. Thus, if parents have equal influence on daughters' and sons' marriages, daughters would be less likely to match their evolved mate preferences and should be more likely than men to show fitness differences based on marriage type.

Table 3.5: Most preferred trait in a spouse or in-law for children and their parents, respectively, for 3,307 parent-offspring dyads in the CVFS.

	Parents				
Children	Physical Beauty	Education	High Paying Job	Someone he/she loves	Row Totals
Physical Beauty	33 (1%)	132 (4%)	62 (2%)	19 (<1%)	246 (7%)
Education	180 (5%)	1,034 (31%)	479 (14%)	142 (4%)	1,835 (55%)
High Paying Job	78 (2%)	447 (14%)	354 (11%)	54 (2%)	933 (28%)
Someone You Love	38 (1%)	152 (5%)	73 (2%)	30 (1%)	293 (9%)
Column Totals	329 (10%)	1,765 (53%)	968 (29%)	245 (7%)	3,307

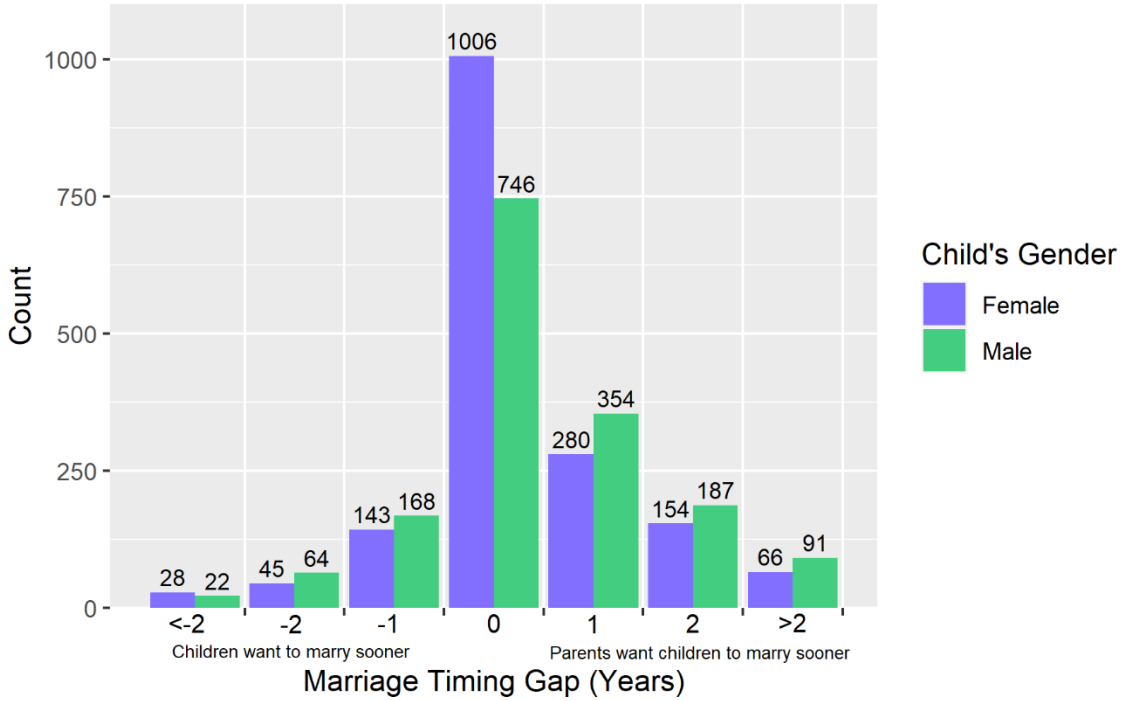
Shaded squares represent concordance in parent and offspring choices.

Figure 3.6: Agreement scores for each type of parent-offspring dyad.



Bars represent percentages while the numbers in each bar represent counts of the dyads in each category. An agreement score of 2 indicates the dyad agrees on both of the most preferred traits (disregarding order) while an agreement score of 0 indicates the dyad did not agree on either of their most preferred traits.

Figure 3.7: The gap between parent and offspring responses to the question "How soon do you want your child to marry (for parents)/ want to marry (for offspring)?".



0 indicates that parents and offspring chose the same interval (e.g., both said “in 5 years”), while numbers represent the number of years between their responses. Negative numbers indicate that offspring want to marry sooner than their parents desire. Positive numbers indicate parents want their offspring to marry sooner than the offspring desired.

3.D. Discussion

Despite the larger sample size, an additional category of marriage type, and adjustment for potentially confounding socioeconomic variables compared to previous studies (Hasnain, 2020; Sorokowski, Groyecka, et al., 2017), no differences were found between arranged- and non-arranged marriages in total births, offspring survival, or first or second interbirth intervals. These results are not aligned with predictions derived from experimental animal studies which demonstrate clear fitness benefits to choosing a partner over being mated at random or with a non-preferred partner. There are many potential

reasons for these opposing results stemming from both methodological and theoretical issues, discussed below.

Measurement of marriage type:

Each fitness outcome was examined with dichotomous and trichotomous marriage categories to explore whether previous research findings no effect of marriage type was simply because the categories did not capture the range of choice in actual marriages (Shenk, 2017). However, expanding the analyses to include three marriage types (Models 1b, 2b, 3c-d) still showed no differences in all fitness measures.

Still, the criteria used to form categories, rather than the number of marriage categories, may obscure differences. This data set separated groups based on whether parents or offspring had more influence in choosing the spouse, but it did not give any indication of the relative influence of each party nor what traits took precedence in partner selection. For example, parents who singlehandedly chose a spouse for the respondent and parents who chose a spouse but obtained approval from the respondent could have both been categorized as "parents had more influence" over spouse choice, despite differing levels of offspring influence. Similarly, some individuals whose parents chose their spouse but obtained offspring approval before marriage could have categorized their marriage as co-selected while others in the same scenario may have categorized their marriage as arranged. Since it is not clear which scenarios led people to report having a spouse chosen by "parents/other relatives", "myself", or "both" in this data set, it is only possible to speculate about what each category includes. Further research designed to examine the fitness benefits of mate choice

should aim to measure several facets of the spouse choice process to create a more dynamic measure of the degree of offspring mate choice.

Furthermore, it is possible that other factors related to spouse choice are more relevant to fitness outcomes. For example, feelings of love should influence reproductive success (Sorokowski, Sorokowska, Butovskaya, Karwowski, & Stephen, 2017), and love can occur in any type of marriage. Reported feelings of love toward a spouse were fairly consistent across marriage types in the CVFS sample (Table 3.3). Likewise, frequency of disagreements was also similar across marriage types in the CVFS (Table 3.4), indicating that compatibility may be independent of marriage type in this sample. To check, I also ran model 1b (trichotomous spouse choice) with an additional covariate for love to see whether feelings of love had an impact on total births, but there were no differences based on love. There were also no differences in total births when using an interaction between marriage type and love. While these results indicate that love does not influence birth outcomes, it should be noted that the CVFS measures love at the time of interview, not the time of marriage, so these analyses may not be capturing the relevant information to test impact of love on births.

Magnitude of parent-offspring conflict:

If parents and offspring agree on the ideal traits in a potential in-law/spouse then they should theoretically prefer the same individuals and thus similar reproductive outcomes would be achieved in arranged and non-arranged marriages. Broader evidence indicates that parents and offspring do not agree on the desired traits in a spouse (Agey et al., 2021; Apostolou, 2011; Buunk et al., 2008; Dubbs et al., 2013; Perilloux et al., 2011). However, these prior studies do not guarantee that parent-offspring disagreement exists in every

context, and any society with low parent-offspring disagreement might not show the expected fitness differentials. Based on the available descriptive data, there is low parent-offspring disagreement in this Chitwan Valley sample, as has been expressed in focus group discussions in other Nepali contexts (Agey, Crippen, Wells, & Upreti, 2023). This offers one potential explanation why fitness does not differ between those whose parents choose their spouse and those who choose their own spouse.

However, the limited scope of questions asked in the CVFS may lead to underestimating disagreement in this context. Parents and offspring were only asked about their first and second most-preferred traits and were not asked about undesirable traits. Previous surveys comparing parent and offspring preferences show highest levels of disagreement over mid-ranking traits (Fugère, Doucette, Chabot, & Cousins, 2017; Perilloux et al., 2011); thus, only probing the top two most preferred qualities would miss such disagreement. Parents and offspring were also not asked about traits shown to produce substantial disagreement in previous studies, such as similar ethnic or religious background. In Nepal, offspring choosing spouses from outside sanctioned caste or ethnic groups may incite considerable parent-offspring disagreement.

Even if there is unmeasured parent-offspring disagreement in this context, parents and offspring may compromise on their desires, or they may be able to find spouses that meet the desires of both parents and offspring in actual spouse-choice decisions (Agey et al., 2023). Even when disagreement does occur, it is possible that parents choose better spouses for their children than children would choose for themselves based on additional ecological knowledge, better assessment of longer-term fitness benefits, and their greater bargaining power in the mating market and over their offspring. These diverse factors could help explain

why there are no fitness differences between arranged and non-arranged marriages in these analyses.

Possible compensatory Effects of Arranged Marriage:

It is possible that both arranged and non-arranged marriages are beneficial for fitness but in different ways. While, theoretically, freely choosing a partner could lead to better fitness via genetic compatibility, having a parent choose a mate could also provide fitness benefits. For example, arranged marriages may strengthen social ties within and across communities in ways that affect fitness (Wiessner, 2009). In Nepal, it is not uncommon for couples who marry against their parents' wishes to be ostracized or discriminated against in their communities, making social support a tangible benefit of arranged marriage. Parents may also provide direct "compensation" for offspring who accept their parents' wishes, such as larger inheritances, higher marital payments, or additional grandparental care. Previous research indicates that parents sometimes threaten ostracism or reduced financial access if offspring do not accept an arranged marriage (Agey et al., 2021), indicating that this is a real cost that could sway individuals away from non-arranged marriages, especially in contexts where material wealth is inherited and can have compounded effects across multiple generations, such as in the Chitwan Valley. Thus, if couples in arranged marriages receive more financial and social benefits in ways not identified in the current study, such compensation may offset other costs of arranged marriage, thereby contributing to the null results in this study. These benefits of arranged marriage may be especially important for long-term or intergenerational buffering against environmental, social, or epidemiological

crises. This possibility should be considered in future research, but such data were not available from the CVFS database.

Fitness measures:

It is possible that this study failed to find fitness differences between arranged and non-arranged marriages because of the fitness outcomes measured. In countries like Nepal, where the demographic transition is well underway, variation in measures of fertility and offspring survival may be limited. Furthermore, this area of Nepal has ample access to prenatal and perinatal care, so offspring survival may be equalized by healthcare access. However, given the consistency between the results of this present analysis and previous analyses of fitness and spouse choice (Hasnain, 2020; Sorokowski, Groyecka, et al., 2017) this result is likely not simply a result of the Nepali context. Free mate choice improves offspring growth and health in several experimental animal studies, and this fitness outcome may also be worth examining in human populations. Measures of offspring health or growth were not available at the writing of this paper, but these indirect fitness outcomes may differ based on marriage type. If self-chosen mates confer "good genes" better than parentally-chosen mates, as would be the case for a trait such as MHC discordance (Winternitz, Abbate, Huchard, Havlicek, & Garamszegi, 2017), then child health should be improved for those in non-arranged marriages.

3.E. Conclusions

Women whose parents chose their spouse, women who chose their own spouse, and women who chose a spouse in collaboration with their parents show no differences in total

births, offspring survival, or interbirth intervals to their first and to their second child. This is surprising because individual mate preferences likely evolved to target fitness-relevant traits, and experimental studies with non-human animals show reduced fitness when mate choice is limited. The failure of arranged marriage to produce effects that match those of experimental animal studies has now been replicated across multiple populations with different cultural and ecological contexts (Hasnain, 2020; Sorokowski, Groyecka, et al., 2017). There are several potential reasons why the human and non-human studies present different findings. First, the most fitness-relevant elements of spouse choice may not be captured by dichotomous or trichotomous marriage types. Assessing spouse choice from a series of questions about who initially found the spouse, whether parents and offspring communicated about a potential spouse, and whether either party gave approval can produce more precision on the degree of independence in spouse choice. Second, parent-offspring disagreement over preferred traits in a spouse appears to be low in this community, at least based on the limited assessment available in the CVFS. If there is minimal disagreement in this or other cultures with arranged marriages, then fitness differences would not be expected between those choosing their own spouse and those whose parents are choosing their spouse. Lastly, involving parents in marriage decisions may provide other benefits that could compensate for any fitness costs of not independently choosing a mate. Large marital transactions, inheritances, trade networks, alliances, and/or additional grandparental care may even outweigh the benefits of choosing a mate independently. If this is the case, independent mate choice and parental mate choice may have similar fitness consequences, making human mate choice unique among animals.

3.F. Data Availability

This research uses data from the CVFS, whose PI is William G. Axinn. The CVFS is a longitudinal study and data collection is funded by multiple grants [No. RO1-HD032912, RO1-HD033551 and 5 R37 HD039425) from the National Institute of Health, Eunice Kennedy Shriver National Institute of Child Health and Human Development and Fogarty International Center. Persons interested in obtaining data files from the CVFS should contact the Inter-University Consortium for Political and Social Research, The University of Michigan, Institute for Social Research, P.O. Box 1248, Ann Arbor, MI 48106-1248, netmail@icpsr.umich.edu.

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Chapter 4: Socioeconomic benefits and limited parent-offspring disagreement in arranged marriages in Nepal

Authored by:

Elizabeth Agey

Savannah Crippen

Alyx Wells

and

Parash Upreti

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4.A. Introduction

Numerous studies of human mate preferences have identified particular desirable traits and the fitness benefits they supposedly confer on offspring. But is there an actual connection between these desirable traits and better fitness outcomes? This underlying assumption, that mate preferences increase fitness, has been tested several times in animal studies, where experimenters either assign a random mate or allow the animal to choose a preferred mate. These experimental studies largely confirm fitness benefits to free mate choice, including offspring viability (Anderson, Kim, & Gowaty, 2007; Drickamer, Gowaty, & Holmes, 2000; Partridge, 1980), growth (Drickamer, Gowaty, & Wagner, 2003; Havens, Orzack, & Etges, 2011), and immune function (Raveh et al., 2014). Parallel attempts to demonstrate similar benefits of free mate choice in humans, using arranged and non-arranged marriages as proxies for limited and free mate choice, respectively (Agey & Gaulin, 2018; Sorokowski et al., 2017), have so far failed to detect differences in offspring survival or in time to first reproduction for couples in arranged versus non-arranged marriages. There are several fundamental differences between the animal experimental design and human arranged marriages that help explain their discrepant empirical results. In contrast to experimental studies, arranged and non-arranged marriages are not randomly distributed in society. Furthermore, even in cases where offspring have little influence on spouse choice, their parents are still exhibiting mate choice on their behalf.

This article will explore other reasons that comparison of arranged and non-arranged marriages may be an inappropriate proxy for experimental animal studies by examining ethnographic data from focus group discussions in Dhading District, Nepal, a culture with a rich history of arranged marriages. These discussions demonstrate that parents and offspring

may have more agreement when choosing an in-law/spouse than previously assumed, that parent-offspring agreement is stronger between parents and sons than parents and daughters, and that arranged marriages can offer benefits that may compensate for any potential fitness loss from not choosing one's own spouse, particularly for women.

Marriages arranged by parents or other kin are widespread (Apostolou, 2007; Broude & Greene, 1983) and have likely existed at least since the first modern humans left Africa (Walker, Hill, Flinn, & Ellsworth, 2011). Arranged marriages vary in the degree of parental involvement: Sometimes parents choose mates for their children with no input from the marrying individuals, but sometimes parents get approval on their choice from children before settling a marriage agreement (Shenk, 2017). Arranged marriage rates are higher for women (Broude & Greene, 1983), potentially producing couples where husband and wife had different degrees of spouse choice; for instance, a husband could independently negotiate his marriage with a bride's parents with little input from the bride. Due to this asymmetry, the effects of arranged marriage could be more pronounced for women than for men. Arranged marriage is also more common and more parentally-controlled in agricultural societies and societies with other forms of inherited wealth (Apostolou, 2010b, 2012), and in these contexts there may be strong economic incentives for arranged marriage.

When arranging a marriage, the interests of parents and offspring are not expected to fully align. Parents should broadly focus on the interests of the family because they can gain fitness equally through each of their children, while offspring gain more fitness through their own reproduction than through the reproduction of their siblings (Alexander, 1974; Trivers, 1974). Parents express stronger preferences for matches that increase or solidify social networks and prestige, as this can increase fitness for all of their offspring (Agey, Morris,

Chandy, & Gaulin, 2021; Apostolou, 2008b). Parents also place more emphasis on choosing in-laws from the same ethnic or religious background while offspring place more emphasis on markers of genetic quality, such as physical attractiveness (Agey et al., 2021; Apostolou, 2011, 2015; Bovet, Raiber, Ren, Wang, & Seabright, 2018; Buunk, Park, & Dubbs, 2008; Perilloux, Fleischman, & Buss, 2011). Because some markers of attractiveness are complementary rather than absolute (e.g., MHC discordance which is dependent on one's own genetic profile), parents may be less able to choose the most genetically compatible mates for their children. Parents may also prefer that their children, especially daughters, marry at younger ages than offspring prefer because it allows parents to exert more control over spouse choice (Apostolou, 2010a). Because arranged marriages are more common for women than for men, daughters may thus achieve their own mate preferences less frequently.

While there is scope for disagreement between parents and offspring, there should also be significant overlap in their interests. Surveys have found agreement between parents and offspring over traits like kindness, personality, and intelligence (Apostolou, 2011; Fugère, Doucette, Chabot, & Cousins, 2017; Perilloux et al., 2011), and greater general agreement in collectivist cultures (Guo, Li, & Yu, 2017). Additionally, parents could have greater ecological knowledge or experience that make them well suited to find quality partners for their offspring. The more regular pattern in cultures with arranged marriage may be for parents to find a spouse for their offspring that meets all parties' criteria. Parents and offspring may also be willing to compromise on less important traits provided that each of their strongest preferences are met. If parents and offspring often cooperate or compromise, then their disagreements may have limited fitness effects.

In many cultural contexts, the social, financial, or resource-related benefits predicated on an arranged marriage may further push offspring to cooperate or compromise with their parents over spouse choice. Because parents are older and often control access to property or social networks, individuals who marry against their parents' wishes may face strong sanctions from parents and/or the community. Parents may threaten to withhold the family's resources (e.g., property or money) if their children do not agree to an arranged marriage (Agey et al., 2021). Offspring that have arranged marriages also have greater access to alliance, trade, and kin networks than do their peers in non-arranged marriages (Wiessner, 2009). Ostracization from parents, kin, and community may also reduce the scope of alloparental care, especially from grandparents. Because grandparental care has been tied to offspring survival (Sear & Mace, 2008), parents may be able to encourage arranged marriages by threatening to withhold grandparental care from children of non-arranged marriages. Since maternal grandparents seem to have the greatest impact on survival, women may be further incentivized to accept arranged marriages in cases where their parents may withdraw support. Thus, while preventing individuals from choosing a mate independently could reduce some genetic fitness components, parental choice via arranged marriage may provide many other benefits that could compensatorily enhance fitness.

In order to fully comprehend the ways in which spouse choice may affect fitness, it is important to understand (A) the ways in which spouses are chosen, (B) the qualities that may produce disagreement, and (C) the costs and benefits of different modes of spouse choice in the community of interest. Using in-depth focus group discussions from a community in Dhading District, Nepal, we will explore these three topics and how they might affect fitness. These data will illuminate the reasons why comparison of arranged and non-arranged

marriages does not show the same fitness differences as limited and free mate choice in animal experiments. It will also demonstrate the types of ethnographic work that must be done in order to make meaningful predictions about the fitness consequences of spouse choice in a particular community.

4.B. Methods

4.B.i. Study Population

Many populations in Nepal traditionally practice arranged marriage. However, over the past 50 years Nepal has begun a dramatic shift in marriage practices, including fewer child and adolescent marriages, more inter-caste marriages, and greater offspring participation in spouse choice (Ghimire, Axinn, Yabiku, & Thornton, 2006). This shift has produced a cohort of individuals in Nepal whose marriages vary from arranged to non-arranged. In addition to this significant variation in marriage type, the national divorce rate is less than 1% and remarriage, especially for women, is uncommon (*Nepal Population and Housing Census 2011*, 2012). Thus, choosing a spouse is effectively permanent, making this a useful context in which to examine the effects of different modes of spouse choice.

In many castes and ethnic groups in Nepal, marriages are traditionally restricted to members of the same caste and subcaste, but not within the same *gotra* (lineage). Caste is primarily inherited through males, but there are also subcastes that are specific to intermarried couples that can change the caste of their children. For example, the Khatri Chhetri subcaste denotes the presence of an intermarriage between Brahmin man and non-Brahmin woman (Höfer, 1979). Parents may informally recruit a *lami* (matchmaker), usually extended kin or acquaintances who live in other locations, to help search for suitable spouses.

After marriage, women traditionally live with their husband and his family. Historically, dowry was an important part of marriage negotiations, providing financial transfer from the bride's family to the groom and his family. While the practice has been illegal in Nepal since 2009, the law primarily prevents the groom's family from requesting specific items rather than preventing significant marital gift giving. While daughters traditionally receive financial transfers at marriage, sons primarily receive financial transfers through inheritances. Prior to 2017, Nepali law required inheritances to be split equally among all sons but did not require any transfer to daughters (National Civil Code Act, 2017). Nepal does not legally allow marriage until age 20 for either men or women (National Civil Code Act, 2017). Most marriages adhere to this law, but it is not always well-enforced, especially in rural areas where marriages are not always registered with a government office.

The data for this study were collected in a large community (over 20,000 people) in the Dhading District of Nepal, which lies directly west of the Kathmandu Valley. The community has access to a major highway, and socioeconomic status varies with proximity to the highway. Most individuals in the community are farmers or shopkeepers, and women traditionally work within the household. Many people under 30 years of age have achieved the equivalent of a high-school education or beyond, but education levels decrease with age and for women. The community includes members of a variety of castes and ethnic groups, with the highest representation coming from Brahmins, Chhetris, Tamangs and Newars. While most marriages in the community adhere to the national law about marriage age, some people in the community, particularly women, marry as teenagers. Marriage under age 16 is rare among individuals married in the last 40 years. Based on data we collected in the community, 78.6% of people in the oldest generation have said their spouse was primarily

chosen by their parents. Of people married in the last 15 years, only 56.2% said their parents were primarily responsible for their spouse choice, mirroring the widespread shift in Nepal from arranged to non-arranged marriages. The variation in marriage type within a single generation makes this community a good place to examine the diversity of methods of spouse choice and explore their potential fitness effects.

Figure 4.1: Image of the study site in Dhading, Nepal, showing the highway that passes through town, terraced fields, and the hilly terrain.

4.B.ii. Data Collection

Semi-structured focus group discussions were conducted in 2019 and 2022. Participants were recruited via convenience sampling in various neighborhoods within the community, and recruitment was done at different times of day to target people with varying

work schedules. Participants were told they could bring a friend or neighbor of the same gender and approximate age to participate in the group as well, in the hopes that some familiarity within the group would facilitate more casual and lively conversations. A few (3-4) women across these groups brought mothers- or daughters-in-law to participate; in these cases, they were placed into separate groups based on age. All participants were recruited by local research assistants, as previous experience showed increased trust and willingness to participate when local assistants were involved. Men and women were recruited from three life stages that roughly mirror age cohorts: never-married adults ages 18-30, adults married within the last 10 years, and married adults with adult children (hereafter referred to as unmarried, recently married, and older, respectively).

Individual focus groups comprised homogeneous gender and age groups (e.g., older women). Discussions were facilitated in Nepali by a trained local research assistant of the same gender as the participants and were limited to one hour. In total, we conducted 19 focus groups with an average size of 5.6 participants. The number and composition of focus groups can be found in Table 4.1. Most of the unmarried individuals were students at the time of the discussions (50%). A majority of the married men ran local businesses (52%) or were in the service industry (33%). Most women interviewed were either farmers (60%) or shopkeepers (33%). While participant incomes were not collected, generally those who work in business or run shops tend to have higher incomes than farmers or those who do service jobs.

Table 4.1: Focus group summary statistics for each demographic category.

Groups	N groups	Total respondents	Mean Age	Mean N of Children	Mean Age of Children
			Men		
Unmarried	2	12	21.9	0	NA
Recently married	2	13	34.2	1.5	5.5
Older	2	11	49.0	2.75	19.9
			Women		
Unmarried	4	25	19.56	0	NA
Recently married	4	26	33.4	2.0	13.1
Older	3	19	47.8	2.9	26.4

Note: Unmarried included adults aged 18-30 who have never married, Recently married included individuals of any age married within the last 10 years, and Older included ever-married adults with children aged 16 or older. All ages are in years.

Focus groups were designed to target topics that were relevant to each group's life stage. The facilitators were given a list of potential questions and vignettes to generate discussion but were instructed to allow conversation to flow naturally and alter the questions or their order accordingly. Unmarried adults were asked questions about dating, the marriage process, desirable qualities of potential spouses, and relationships with their parents. Recently married adults were asked about the process of finding a spouse, their lives after marriage, and about starting a family. Older adults were asked questions relating to their children's marriages (or future marriages) and their own lives after marriage. Many discussion topics were chosen to target our specific research questions:

A: What types of marriages exist in the community and what are the characteristics of each? (i.e., is spouse choice dichotomous?)

B: Do parents and offspring agree over the ideal qualities of an in-law/spouse, respectively?

C: What kinds of social and financial outcomes are tied to spouse choice decisions?

Most of the questions prompted participants to think about the community generally rather than about their own experiences to increase openness, especially surrounding more difficult or taboo topics, such as dowry, marital disagreements, affairs, and fertility.

All focus groups were recorded, transcribed in Nepali, and translated into English by a bilingual native Nepali speaker. The Nepali-English translations were checked by a second bilingual native Nepali speaker (Author P.U.) to ensure their accuracy. Translations were also checked to make sure that important context was not lost, paying close attention to culturally-specific words or phrases that have implied meanings or do not translate literally. Where necessary for clarity, notes on such meanings are inserted into quotes in square brackets.

4.B.iii. Data analysis

English transcripts were read and independently coded for content by S.C. and A.W. When a new topic was identified, it was added to a codebook and given a brief description to maintain consistency of use in future coding. The coders then cross-checked each other's work for accuracy and comprehensiveness. All authors read the transcripts in full, and each author independently kept notes on themes they noticed, statements that were surprising, and clear differences between demographic groups.

After this initial coding, statements were reorganized by code with tags denoting the gender/age group where it originated. Following the reorganization, all statements from each theme were read together. The authors noted any differences based on age or gender, as well

as other distinctions drawn by participants, including statements about different behaviors among the rich/poor, rural/urban, or past/present. These themes and patterns were discussed in biweekly meetings in which the authors compared their observations to each other's observations, as well as to their own notes from earlier readings of the transcripts. The patterns and themes described in this analysis were agreed upon by all authors.

4.C. Results

4.C.i. Is the mode of spouse choice a dichotomous variable?

Focus group discussions identified three types of spouse choice in marriage: arranged marriages, love marriages, and elopements. Each vary on the autonomy of the spouse-choice decision (summarized in Table 4.2).

Arranged Marriages

Arranged marriages were characterized as marriages in which parents (or other relatives) find and select a potential spouse for their children. This may or may not include a child's approval of the parent's choice. While respondents also sometimes used the term "arranged marriage" to refer to cases in which a family approved of a spouse the child chose for themselves, such cases more closely resemble the description of love marriage, discussed in more detail below. Arranged marriages were categorized as a form of respect and obedience toward parents by some respondents, especially unmarried women:

> "If they are the kind of daughters that listen to their family, then most of the time, they would do arranged marriage. But if they are *chanchal* [more extroverted] and

have seen the city and city life, then those kinds of girls tend to do love marriage." - Unmarried woman

Arranged marriage was seen by almost all groups as a contract between the whole families of the bride and groom. Families are deeply involved in choosing and approving a spouse, the marriage ceremony, and post-marital life, for example:

> "If you find a husband yourself, then whatever happens between the two of you cannot be shared with other people or your family because you are the one who chose him. But if it is arranged and you don't like your husband, and if he does not treat you well, you can yell at your parents, "what kind of man did you get me?". (Audience laughs)" -Recently married woman

Respondents identified types of people who were more likely to engage in arranged marriages. The groups noted that children that were passing the optimal marriage age were more likely to have arranged marriages. Participants identified two primary reasons why an individual may not be married by this time: individuals may be too timid to find a partner independently or individuals may have dated a self-chosen partner but experienced a difficult breakup.

Arranged marriages were repeatedly identified by respondents as the most common type of marriage in the community and across socioeconomic groups, but many of them noted that love marriages are becoming more common.

Table 4.2: Summary of marriage types and their associated forms of support

	Arranged Marriage	Love Marriage	Elopement
Who initially finds spouse?	Parent(s) or other relatives	Offspring	Offspring
Does the other party approve of spouse choice?	Offspring may or may not approve	Yes	No (or parents were never asked)
Financial Support	Dowry/Gift Giving, Inheritance	Dowry/Gift Giving, Inheritance	Inheritance
Social Support	Strong, Family can mediate conflicts, better relationships with in-laws	Medium, Acceptance from family and community but less family involvement	Low for months to years after marriage
Grandparental Support	Strong desire to invest in grandchildren, pressure to quickly have children, more likely to reside with grandchildren	Desire to invest, but less pressure to quickly have children, may or may not reside with grandchildren	Elopements forgiven after grandchildren are born, but investment may be limited by separate residence from grandchildren

Love marriage

Love marriages were described by respondents as cases in which children found someone they would like to marry and sought parental approval for the marriage. Following parental approval, these matches are formalized through the same traditional marriages rites and ceremonies that occur in arranged marriages. Thus, love marriages and arranged

marriages differ primarily by who initially finds the spouse. Parents seem to be relatively accepting of their child's wishes in these types of marriages:

> "But nowadays, in most of the cases, even if it is love marriage, the kids make sure that they introduce each other's family and make them acquainted. And they will marry according to the traditions. What we can say is even though it is a love marriage everyone is happy since the permission has been asked to the concerned people in the family." -Older woman

> "Today's generation knows a lot. Both will check each other's background regarding their lifestyle and what they want to do in their life [when they choose their own spouse]. They will see how much love they can give to each other and stuff like that." -Older man

Love marriages are characterized as more independent than arranged marriages, and this independence spanned the entire process from choosing a spouse to post-marital life. Even if parents agree to the child's spouse choice, they do not see themselves as having rights to intervene in the couple's life. Most respondents said that love marriages are becoming increasingly common, with a few respondents saying this is now the most common type of marriage occurring in the community.

Elopement

The last type of marriage identified by respondents was elopement. This type of marriage was described as running away to get married without any parental approval. This

could occur after a rejection or an anticipated rejection of a potential spouse by parents. These marriages were often described as a form of disobedience or extreme independence. Elopements are very often tied to breaking societal marriage rules, including marrying outside of the proper caste.

Some respondents noted that elopements are a good way to save money that would typically be spent on a wedding, indicating that elopements may be more attractive to people who cannot afford a wedding ceremony. However, the overwhelming majority of people characterized elopements as being very undesirable, both among family members and the community. Some respondents stated that love marriages may sometimes be accepted just to avoid the stigma of an elopement:

> "Parents are also giving them permission to do love marriages to secure their reputation. They're giving their children permission so they don't elope or their parents don't have to feel insulted in society." -Unmarried woman

Despite this undesirability, individuals also reported that elopements are very often accepted after some time, especially after the couple has children:

> "Once they [run away and] get married then slowly, they will form positive relationships with both of the families. It is going to take some time, but time heals everything. Eventually the son-in-law will get the love and respect that they are expected to get."
>
> -Older man

Elopements were continually described as rare events, and the least common type of marriage.

4.C.ii. Do parents and offspring agree on the ideal qualities of an in-law or spouse?

The focus groups were asked to describe what qualities make a good spouse, or what qualities they would look for in a spouse for a son or daughter. Respondents freely listed 26 different qualities, but only traits that were expected to produce disagreement based on previous research on parent-offspring disagreement over spouse choice (Agey et al., 2021; Apostolou, 2010a; Buunk et al., 2008; Perilloux et al., 2011) are discussed below. The results are summarized in Figure 4.2.

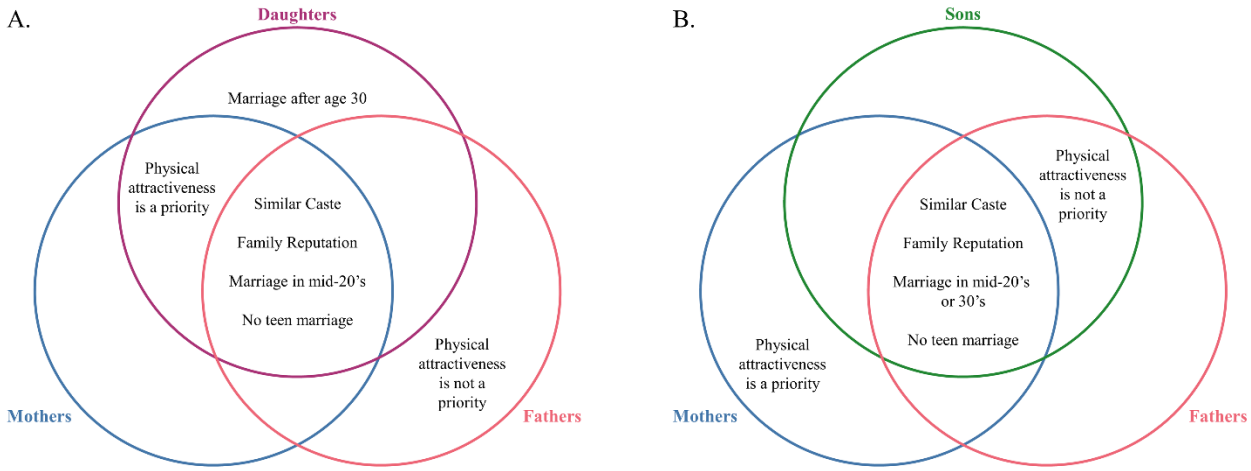

Figure 4.2: Potential for parent-offspring agreement and disagreement over traits in a potential spouse.

These diagrams represent the potential for disagreement between daughters and their parents (A) and sons and their parents (B) based on focus group discussions with unmarried and older participants. Areas of overlap represent agreement on the listed traits, while non-overlapping areas represent disagreement.

A. Daughters, mothers, and fathers agree that a potential spouse should be of a similar caste and come from a family with a good reputation. They also agree that marriage should occur in the daughter's mid-20's and not occur in their teenage years. Mothers and daughters agree that physical attractiveness is desirable and important in a potential spouse. Daughters sometimes express a preference to marry after age 30, which would not be desirable for mothers or fathers.

B. Sons, mothers, and fathers agree that a potential spouse should be of a similar caste and come from a family with a good reputation. They should also agree that marriage should occur in the son's mid-20's or 30's and not occur in their teenage years. Sons and fathers agree that physical attractiveness should not be a priority for choosing a spouse, while mothers think that physical attractiveness is desirable and important.

Caste

Caste, which is associated with the same religion and cultural/ethnic group in this community, was an important factor in spouse choice for most groups, and many people identified it as the very first trait they would consider in a potential spouse. Participants commented that a bride and groom's castes should match, and that lower-caste brides would face discrimination by their in-laws after marriage. Marrying someone of a different caste was also deemed unacceptable to society generally, so the stigma seems to extend beyond the family unit.

Older participants pointed out that younger individuals or individuals choosing their own spouses are less likely to care about caste:

> "When they choose their life partner themselves, they don't really look at the caste and religion but of course they will be checking for whether he/she can sustain the household and whether they are hard-working and can take responsibilities or not." - Older man

However, several unmarried respondents identified caste as an important factor in spouse choice. They also recognized the importance of caste to their parents and showed willingness to discuss and compromise with their parents if they wanted to marry someone of a different caste:

> "If we want to marry someone from the lower caste family, then we have to convince our parents that they love us despite our caste. We should see if he is a hard-worker or not, and if he loves us or not, not what his caste is and how rich he is. Yes, this issue is still a lot in the society, but the society is slowly getting more progressive." - Unmarried woman

Some parents showed a similar willingness to compromise on the issue of caste, for example:

> "Well, if they are from lower caste, then the community might not respect us. But if they can't live without each other, then we have to go with them." Older woman

Some older individuals said inter-caste marriages (often elopements) would eventually be accepted if the couple really loved each other and/or if they have children. Overall, these discussions indicate more alignment of interests between parents and offspring, as well as more willingness to compromise, than anticipated based on previous research.

Physical Attractiveness and Health

Attractiveness was mentioned by many groups, but women seemed to mention physical attractiveness as a desirable trait more than men. Women across all age categories listed attractiveness as a desirable quality in a husband, daughter-in-law and/or son-in-law, although it was often not the first quality listed. Men, on the other hand, repeatedly stated that physical beauty should *not* be a priority in marriage, if they mentioned it at all. Several unmarried men pointed out that beauty fades over time, and that other qualities are much more important:

> "We try to find beautiful girls for us but beauty will one day wither away, so this aspect normally comes last." -Unmarried man

> "Beauty does not really matter as long as she is like average looking because I have seen some people who get married with an extremely beautiful girl, and one day the girl will just elope with another person who might be richer. So, it's safer to marry an average looking girl." -Unmarried man

Men stated that physical attractiveness should not be a priority even in non-arranged marriages:

> "If you fall in love with someone then you marry her. If you really love the woman not for sex but for her characteristics, her emotions, the way she presents herself then your marriage will be successful. But if you only marry a woman for sex then in the long run it might not be successful." Recently married man

Most older men mirrored this sentiment, saying that beauty was not enough to make a good daughter-in-law and that a son-in-law did not need to be handsome as long as they can take care of their daughter:

> "When we look for a groom, we try to find a person who is gentle, hardworking, that does not have any affairs with other women, should have a job (especially a government job). If he possesses these qualities, then even if he is not that handsome it is fine because he can look after our daughter." -Older man

While physical attractiveness may not be a priority for men, one group of unmarried men did mention that a potential bride should be free of disease and long-term health issues. This, combined with discussion of finding an "average looking" girl, may indicate that these men have a minimum threshold of physical attractiveness. Women of all ages in the community appear more concerned about physical attractiveness than men, possibly indicating some disagreement between daughters and their fathers.

Family Status, Reputation, and Affluence

The quality of the potential bride's or groom's family was commonly identified as an important factor in spouse choice. A "quality family" has wealth and property, exhibits good behaviors (e.g., they do not fight with themselves or others, they refrain from drinking), and is well-regarded by others. "Good behavior" and "high status" were identified multiple times as more important than the family's wealth, although familial wealth and property were still important. Wealth was repeatedly identified as a bargaining chip used by parents and matchmakers to convince a man or woman to accept an arranged match.

Unmarried men and women listed family reputation as a desirable quality when considering a wife or husband; however, when unmarried women expressed desire for grooms from good families, they also clarified that the groom himself should have good behaviors. Women repeatedly stated that family status was not always a worthwhile quality to consider because it cannot make up for bad qualities of a groom.

> "Sometimes the person chosen by parents might have vices, like drinking, smoking, or violence, and choosing by yourself is a better option." Unmarried woman

This indicates that women, while they do value good family background, only perceive family background as a reliable signal of quality when the groom is also well-behaved.

Older men and women also placed high value on the quality of the family of a potential bride or groom. They characterized the quality of the family as a trait to check prior to any discussion of marriage:

> "We make sure that before we give our son or daughter for marriage, we ask the society around in which our sons and daughters are going to get married whether the family are good or not. If they have any bad aspects [we ask] what they are. We make sure that we understand the family clearly before giving our children to them." -Older woman

The focus on family quality by parents may cause some disagreement with offspring, particularly daughters, who may weigh the behavior of the potential groom more than the quality of his family.

Age at marriage

In the focus groups, almost all ages and genders stated that the ideal age of marriage is between 20-30 years old, but most responses were concentrated in the 20-25 age range. Many respondents, including both men and women, stated that finishing school and getting a job is important to do before considering marriage. Virtually all participants agreed that marrying as a teenager or before maturity is not ideal. Marrying as a teen was repeatedly tied to elopements in these discussions. Many older individuals pointed out that age and maturity were major factors in whether love marriages would be successful, indicating that parents may be less likely to accept non-arranged matches if they perceive their offspring to be too young:

> "If you do love marriage at a very early age, then it might be unsuccessful because you have not seen the whole world yet. And when you get more mature, then you

have feelings that you want to date other people as well, and this could be the reason for divorce in love marriage if you do it early." -Recently married man

However, arranged marriages in the community sometimes also take place at ages younger than the stated ideal marriage age. Some of the women expressed discontent about having arranged marriages at young ages:

"In my time, I got married at 16, then I had a kid at 18, and now he is already 25 and I am 40 years old. I did not want to get married at that age, but as you know, we had to do what our parents and society told us to do. If I was young again, I would marry at 25 or 30 years old." -Older woman

Because marriage ages have increased in Nepal, due to both secular trends and passing of laws about marriage age, it is possible that disagreements over marriage age in arranged marriages are decreasing.

While there is general concern over marriages taking place too young, older individuals also expressed concern about waiting too long for marriage, particularly for women. Conversely, several unmarried women emphasized their desire to have a career, become independent, and marry in their mid or late twenties. Unmarried women noted the disconnect between parental desires and their own desires:

"When we turn 20 or 21 our parents start to talk about marriage and they'll start to look for a groom. But we don't want to get married earlier, so we'll get married after we are 30 years old." Unmarried woman

There is also a gender difference in preferred marriage age in this community, as some respondents stated that a 3-4 year age gap between husband and wife is ideal (but note that women did not prefer *too* large of an age gap). Two groups also pointed out that men are mostly immune from family pressure to marry, while women are more likely to face pressure. Thus, there may be disagreement between women and their parents when it comes to marriage timing. For example, if a man wants to marry at 23 years old, then his potential wives may be only 19 or 20, which is below or at the bottom the women's stated ideal age range for marriage. If women simultaneously face more pressure to marry at younger ages than men do, the conflict between their stated ideals and parental pressure may lead to conflict.

4.C.iii. What kinds of social and financial effects are tied to spouse choice decisions?

It is possible that allowing parents to choose a spouse, or at least seeking their approval for a spouse, is tied to certain benefits for the couple that would be lost if parents are not involved in the spouse choice. The results below are summarized above in Table 4.2.

Family and community support for the marriage

Elopements, especially inter-caste elopements, were consistently identified as undesirable or unacceptable, and they elicit less family and community support than arranged or love marriages. Respondents repeatedly stated that these consequences seem to be directed toward women who elope more than men who elope.

> "Towards the daughter-in-law who had an elopement marriage, parents might love and respect her less but towards a son there is no discrimination." -Unmarried man

Several circumstances lead to acceptance of eloped couples, including having children, becoming financially independent, or a bride fulfilling the expectations of her in-laws. But even with parental acceptance, many groups stated that couples who eloped cannot complain about their marriage since it was their choice. Marriages that were based on love may also still face increased conflict, especially between mothers- and daughters-in-law:

> "I think in marriages that were not arranged, daughters-in-law and mothers-in-law fight more. In an arranged marriage, the daughter-in-law knows that the family is chosen by her parents, and if she argues, then it does not show good upbringing. But in love marriages, it is the son who brought her in the house. So, the son is more inclined to his wife and therefore the wife has power and support to quarrel with her in-laws." -Recently married woman

The timeline for which elopements are accepted varied widely between respondents, ranging from a month to 10 years, indicating varying degrees of social sanctions for eloping.

Financial benefits

As mentioned briefly above, there is a general expectation in this community that eloping couples should be more financially independent than their arranged-marriage counterparts. While some couples may elope to avoid large wedding costs, there may also be financial benefits tied to arranged marriages (described below) that eloping couples are less likely to receive.

While dowry has been illegal in Nepal since 2009, the practice still exists in various forms and areas of Nepal. Many respondents identified that traditional dowry (gifts from the bride's family that were requested by the groom and his family) has been replaced by gift-giving at the discretion of the bride's parents. There are a variety of gifts given to the bride at the time of marriage, even if these were not considered a formal dowry. Some commonly identified items were TVs, furniture, clothing, appliances, gold jewelry, and automobiles. Gifts may also include cash or loans to a groom to start a business. These gifts belong exclusively to the bride, and by extension the groom, except in the case of large, shared items (i.e., a refrigerator would be shared by the groom's family and thus would have more ambiguous ownership). Some participants noted that dowry items used to be owned by the groom and his parents, but this view has mostly disappeared. One respondent stated that in the case of divorce, a bride could take back all her dowry/gifts.

Gift-giving and/or dowry was consistently identified as more prevalent in arranged marriages, as it is part of the formal marriage negotiations and ceremony. Women in these focus groups tended to perceive dowry as staying the same, increasing, or being informally required despite its illegality:

> "Here in Dhading district, I have found that even though you don't have to give dowry, there are still some families that keep on hoping for something in each and every festival, rituals and ceremonies from the bride's family. It is not clearly visible, but it happens in a lot of families." -Older woman

> “I think dowry is increasing more nowadays. Lots of families in my society have not done their daughters' marriage because they are weak and can't give dowry.” - Recently married woman

While men identified a shift from dowry to gift-giving, men consistently flagged dowry as decreasing or absent in the community:

> “In previous times, they used to give dowry because that was the trend in society here. That trend is still there, but nowadays people give because they want to give something to their daughter and son-in-law. It has drastically reduced compared to the previous time.” -Recently married man

Most instances where women identified dowry as decreasing or absent were in discussing their own marriages or opinions, not when discussing the community generally:

> “I did not give any dowry in my marriage. Even at my daughter’s wedding, I will not be giving any dowry. I don’t need other people’s property [literal translation: to me other people’s property burns my body].” -Recently married woman

> “For me, there is no importance of dowry at all. With the dowries all you can do is decorate a room. It does not give you happiness or feed you. It does not matter how much we get the dowry but if we do not get a nice daughter in law with good behavior then all those dowries mean nothing. We need daughter in law with good behavior so that they can raise and support the family.” -Older woman

In Nepal, inheritance is another common way through which financial resources and/or property are transferred. Inheritances are traditionally given to sons, although daughters have historically sometimes been given property, especially if a couple has no sons. While current Nepali laws mandate that all sons and daughters in a family are entitled to equal inheritance (National Civil Code Act, 2017), only sons were legally entitled to inheritances before 2017, the time in which most of the married individuals in these discussions would have been married. Based on these data, unmarried men are aware of the laws regarding inheritance, and thus it may not be a decision factor when choosing a spouse:

> "Regarding wealth distribution [inheritance] towards children from the parents, there is not any discrimination because government has made sure of it in the constitution."
>
> -Unmarried man

Inheritance was not discussed by any women in these groups.

Grandparental Investment

Women and older men noted that couples in arranged marriages face significantly more pressure from parents and in-laws to have children quickly after marriage than do couples in other types of marriages. However, recently married men explicitly stated they do not face pressure to have kids earlier, suggesting a gender difference in parental pressure.

> "In arranged marriages, couples have kids earlier than in love marriages because there is pressure from parents to have kids as soon as they get married because they want to play with their grandkids before they die. But in love marriage, parents think that the

couple has decided their life planning themselves and will let them do however they want to live their life." Older man

Since arranged marriages were routinely characterized as having more family involvement and a higher sense of familial obligation than love marriages and elopements, this increased parental pressure to have children is not surprising. Furthermore, this pressure seems to stem from a strong desire to invest in grandchildren as soon as possible. While respondents repeatedly said that parents accept elopements following the birth of the couple's first child, there does not appear to be the same pressure to have children quickly in those marriages.

Direct grandparental investment may also be dependent on proximity. In Nepal it is common for sons to co-reside with their parents and care for them in old age. Participants indicated that it is the parents' choice of which of their sons (and, by extension, daughters-in-law) they live with, often preferring to live with the youngest son. However, respondents indicated that wives could similarly control whether or not they continue to live with their husband's parents:

"Sometimes we have to split with our parents and live with our wife and children. It normally happens because the wife does not like to live with our parents after marriage because she might feel that she is not getting more privacy, or she just wants to live with her husband and children and live life accordingly. Wife is a catalyst." - Recently married man

Older participants repeatedly stated a strong desire for daughters-in-law that would respect them and take care of the household, indicating that this is a salient factor when arranging a marriage. Furthermore, as pointed out in multiple groups, mothers- and daughters-in-law are

more likely to quarrel when there was an elopement or love marriage. It is therefore plausible that parents prefer to live with sons who had arranged marriages. This would lead to additional direct grandparental care being targeted to grandchildren from arranged couples. The relationship between marriage type and indirect grandparental investment, however, cannot be resolved from these discussions alone.

4.D. Discussion

4.D.i. Spouse choice is not a dichotomous variable

It is clear from these discussions that arranged and non-arranged marriage do not represent a dichotomy. Participants identified three types of marriages but described variation within each type. Arranged marriage may or may not have offspring approval of the parents' choice, implying that a broad category for "arranged marriage" may obscure important variation in the degree of choice offspring have. Both love marriage and elopement would technically be considered non-arranged marriages, but love marriage and elopement have very different levels of parental involvement before and after marriage. Thus, sorting marriages based on who initially found the spouse may still not capture the full range of variation in spouse choice decisions. In Dhading, spouse choice may be best measured as an index of several variables, including who originally found the spouse, who initially suggested marriage to that person, whether permission was sought and granted from other parties prior to marriage, and the perceived degree to which each party was able to influence the other in their choice. Furthermore, information offered by participants suggests that husbands and wives may answer questions about spouse choice differently. Approval for a marriage could come from the bride's family, the groom's family, or from both families, and each of these

situations could have different implications for the couple's post-marital life. Failing to capture these sources of variation may make it difficult to accurately differentiate the consequences of partner choice.

4.D.ii. Parents and offspring often agree over the ideal qualities of a spouse

Older respondents were more likely than unmarried respondents to name caste as the first quality they would consider in a spouse for their children. While this may indicate that parents care more about caste than unmarried individuals, there was more willingness to compromise on caste-matching than expected. Parents may face a difficult choice when their children want to marry someone of a different caste because, if parents do not approve of an inter-caste match, the couple may elope instead. Parents may thus be willing to approve an inter-caste love marriage if it produces less stigma than an inter-caste elopement.

While not discussed by participants in these focus groups, the level of compromise over caste likely varies with the size of the gap between the two castes or ethnicities (which are both integrated into a singular system in Nepal). In Nepal, the phrase *pani chalne* indicates castes and ethnicities designated as "pure" enough to drink water given by them. The lower disadvantaged (i.e., Dalit) castes are excluded from this category, but other ethnic groups are considered *pani chalne* (Höfer, 1979). In informal conversation in this community, we have heard parents say they would accept any marriage from a *pani chalne* group. Therefore, it is likely that a marriage between the most advantaged caste levels would be more acceptable than an inter-ethnic marriage between two *pani chalne* groups, and both of those matches would be more acceptable than a marriage where only one party is in a disadvantaged caste. Because caste is passed primarily through males and hypergamy is

formally permitted (Höfer, 1979), parents may be more accepting of sons marrying a lower-caste woman than a daughter marrying a lower-caste man. Thus, women likely face greater sanctions than men for marrying below their caste.

Despite physical attractiveness producing disagreement between parents and offspring in other studies (Agey et al., 2021; Apostolou, 2008a; Bovet et al., 2018; Buunk et al., 2008; Perilloux et al., 2011), these discussions do not indicate strong conflict over this quality. For unmarried men, attractiveness seemed to be a threshold variable: As long as a minimum standard was met, they could be satisfied. The desire for a beautiful daughter-in-law that many older women voiced may mean that sons are able to easily achieve this threshold, even in arranged marriages. Younger women also expressed a desire for physically attractive husbands, indicating that women and their mothers agree in this community. However, older men explicitly stated that a potential husband does not need to be handsome as long as he can provide; thus, disagreement over physical attractiveness is more likely between fathers and daughters than between daughters and mothers or sons and either parent in this community.

Older individuals appeared slightly more attentive than unmarried individuals to the quality of the potential spouse's family. However, unmarried people, especially women, were very clear that the behavior of the intended spouse, especially around drinking or affairs, was *more* important than the quality of the family; for the marrying individuals a bad apple from a good tree was not an acceptable partner. Parents are likely more attentive to the social network and prestige benefits of arranging matches for their children, and they may sometimes perceive this as being more important than the quality of the potential spouse themselves. Parents might also be worse than offspring at obtaining truthful information

about the behavior of a potential spouse (e.g., because such behaviors may be hidden from older individuals in the community). Where there is discordance between the quality of the family and the quality of the potential spouse, there will likely be more disagreement between parents and offspring. However, in cases where the potential spouse's behavior is acceptable, then an arranged marriage would satisfy the preferences of both parents and offspring.

There may also be disagreement over marriage timing, especially between parents and daughters. Parents could be pushing daughters to marry earlier than sons for several reasons-- female reproduction is more closely tied to age, dowry is also traditionally lower for younger brides, and parents can also exert more control over spouse choice when offspring are younger. While older individuals expressed a lot of concern about very young people eloping, they did not seem as concerned about marriage age in arranged marriages. This indicates that parents may be hesitant to allow love marriages to proceed if they consider their children to be too young or immature to choose their own partner. Parents may reject love matches when their offspring are under the parents' ideal marriage age. Conversely, young women facing strong parental pressure to have an arranged marriage before they are ready may have to choose between agreeing to their parents' choice or eloping with a man of their choosing. These factors may explain why elopement is often done by young people. This pattern mirrors patterns of early marriage in Tanzania, in which parents sometimes arrange early marriages to secure socioeconomic stability for their daughters while at the same time being concerned about non-arranged early marriages that appear unstable or based on poor decision making (Baraka, Lawson, Schaffnit, Wamoyi, & Urassa, 2022). Many young women in Dhading expressed a desire to finish school, build a

career, and become more financially independent before marriage. They may see these activities as a way to increase their own status, which could be converted to better matches (Schaffnit et al., 2022), more extensive kin networks (Shenk, Towner, Voss, & Alam, 2016), more parental investment, and better outcomes for their children (Alami et al., 2020). Because, due to legal changes and societal trends, marriage age has been steadily increasing in this community (an offspring preference), this could indicate that more compromise between parents and their children over marriage age may be occurring in recent years.

The overall picture shows some avenues for parent-offspring disagreement, but also shows many opportunities for cooperation and compromise. Parents and their children may work together to meet minimum standards on physical attractiveness, quality of behavior, and family background. Parents may compromise on inter-caste marriages in cases where castes are similar or where elopement is a risk. While disagreement about marriage age may also be common, the levels may be decreasing as average marriage age rises in Nepal. Thus, disagreement may only be present in some parent-offspring dyads, and the risk of disagreement over particular qualities are likely asymmetrical for sons and daughters. Likewise, individuals who are shy or do not have their own prospects may obtain better mates through arranged marriage than if they choose on their own, producing very little disagreement. Similarly, individuals who can independently obtain high-quality mates may be able to meet both theirs and their parents' priorities, again producing very little disagreement. Because elopements (which indicate disagreement) were consistently reported as rare in discussions, it could be the case that parents and offspring are often able to agree on spouse choice in this community. Thus, in cases where both parties cooperate to choose a

spouse (i.e., when parents choose a spouse and the offspring approve or when offspring choose a spouse and parents approve), there may be few fitness consequences.

4.D.iii. Arranged marriages receive compensatory benefits

Generally, those who choose their spouse with no parental input seem to have less access to family support, at least immediately following their marriages. The consequences of eloping appear stronger for women than for men, as many respondents directly stated that daughters-in-law face more discrimination for eloping than sons-in-law. Even if parents later accept an elopement, it is clear that there is less support if the marriage is unsuccessful or faces hardships, as many participants noted that family cannot get involved in conflicts between self-selected spouses. This decreased familial involvement may have significant ramifications in instances of abuse and intimate partner violence, particularly for women, whose statements in these discussions indicated their desire for strong family support. Dowry, which is unlikely to be paid in elopements, was associated with better relationships with in-laws after marriage, consistent with other studies examining relationships between daughters- and mothers-in-law in Nepal (Diamond-Smith, Dahal, Puri, & Weiser, 2020). This could be because marital transfers can help legitimize new couples in the eyes of the family and community, as bridewealth appears to do in Ghana (Akurugu, Dery, & Domanban, 2022). The lack of dowry could therefore produce more conflict, additional stress, or poorer access to resources in the marital household if the couple lives with the husband's family. Respondents noted that husbands were more likely to take their wife's side during family disagreements in eloped and love marriage couples. While this could attenuate some of the stress and improve treatment of a new wife in her husband's family home, this situation was

also tied to the couple establishing a separate nuclear household, thereby further distancing themselves from family. From these lines of evidence, women who choose their own spouses may suffer in terms of support from both her own family and her husband's family. This reduction in material support or increase in interpersonal conflict could increase undernutrition and psychosocial stress, affecting health, pregnancy, and birth outcomes (Hobel, Goldstein, & Barrett, 2008; Schneiderman, Ironson, & Siegel, 2005). Since families are more likely to accept an eloping couple following the birth of a child, the effect of reduced familial support may be the strongest on first births.

Arranged couples, who regularly receive gifts/dowries, may be able to achieve financial stability more often or more quickly than couples that eloped, who are unlikely to receive dowries or gifts at marriage. Marital gifts contingent on approval from the bride's family can contribute to the financial stability of the new couple, especially when they consist of cash, land, or vehicles that can increase access to jobs and markets. The relationship between marriage type and financial support is less clear for men in this community. While men have always been legally guaranteed to receive an inheritance from their parents, parents may distribute inheritances at different times. If timing of inheritance is tied to marriage type, that opens an avenue through which resources could be affected by marriage type for men in this community.

Eloping couples were expected to be more financially self-sufficient, and their parents' acceptance of the marriage was often tied to the couple's financial independence. If eloping couples have less assistance financially from the bride's family (e.g., less gift-giving/dowry) or a delay in assistance from the groom's family (e.g., delayed inheritance), they may take longer to achieve a similar socioeconomic status as arranged couples. Reduced

financial resources could lead couples to delay reproduction, resulting in longer first birth intervals for eloped couples. Because women and men face asymmetrical financial sanctions for eloping, it is possible that the affect of elopement on reproduction could differ based on whether the brides', groom's or both families oppose the marriage.

Further investigation of the types and amounts of grandparental investment by marriage type is required to make predictions about fitness effects. Elopements are often accepted following the birth of a grandchild, and this is due to a desire to invest on the part of the grandparents. However, if couples who elope are more likely to live separately from their parents due to increased tension between daughters- and mothers-in-law or due to general expectations that eloping couples should be independent, then they may receive less direct grandparental investment simply as a result of distance (rather than the grandparents' refusal to offer care). Eloped couples may also receive less grandparental investment if they have children later than couples in arranged marriages because the grandparents are older and less vital or even deceased. Perhaps grandparents who cannot invest as much time in directly caring for grandchildren invest in indirect ways, such as financial support for education expenses. Thus, to test whether there are differences in grandparental investment based on spouse choice, dimensions of both direct and indirect investment need to be measured.

4.D.iv. General Discussion

Overall, these discussions indicate a scope for gendered conflict over spouse choice decisions. Cross-culturally, studies demonstrate that women are more likely to have their marriages arranged than men (Broude & Greene, 1983). In this community women appear to have more disagreement with their parents over the qualities of a potential spouse, but at the

same time have more socioeconomic benefits to gain from arranged marriage. On the other hand, men in this community appear to have high levels of agreement with their parents on spouse qualities and receive financial and social support regardless of marriage type. For this reason, men's fitness may be less influenced by mode of spouse choice, while women face stronger tradeoffs between the potential genetic fitness benefits of independent mate choice and the fitness benefits derived from the socioeconomic support tied to arranged marriages. If the socioeconomic benefits of arranged marriage outweigh the benefits of independent mate choice, then women entering arranged marriages may be making an optimal choice that is better for their fitness and wellbeing.

The choice to have an arranged marriage, love marriage, or elopement may also be heavily dependent on other factors like personality or socioeconomic status. For example, individuals whose personalities are more outgoing or independent may be more likely to choose their own spouses, exert more control over fertility decisions, and also argue with in-laws. Additionally, individuals with low socioeconomic status may have less to lose by choosing their own spouse, and thus may be more likely to take that route. If this is the case and marriage types are not randomly distributed (which is likely), then the qualities of the individuals choosing particular types of marriages may be the reason for any fitness differentials, and this may confound the relationships between the genetic, social, and financial benefits of different modes of spouse choice and fitness outcomes, as seen in other studies investigating to connections between marriage and fitness outcomes (e.g., Lawson & Gibson, 2018). Thus, further research should also investigate the characteristics of the individuals entering into different types of marriages.

4.D.v. Limitations

While a mixture of convenience and snowball sampling allowed us to improve group dynamics and increase discussion, it could also limit the diversity of viewpoints. There were also differences in openness across groups. Unmarried individuals, especially women, were more reserved in sharing their opinions about marriage and relationships, possibly because dating and pre-marital relationships are not readily accepted in society. We attempted to circumvent this issue by asking questions about the community and age group generally, but there may still have been some hesitancy to speak openly. Recruitment may have also been more effective for certain socioeconomic or demographic groups. Attempts were made to recruit in various neighborhoods and at varying times of day to mitigate this, but groups with different demographics may have offered alternative views.

Because many of the questions focused on what is typical in the community rather than personal experiences, we likely missed some variation. While many participants discussed their own experiences unprompted, it is likely that these personal anecdotes reinforced culturally acceptable opinions, while those that do not conform were probably less likely to be shared. We attempted to address this by asking specific questions about socially taboo topics, such as dowry and inter-caste marriages. Likewise, opinions or norms stated in these focus groups may describe ideal situations and not reflect actual behavior in the community.

Because the ways in which these behaviors can affect reproductive and health outcomes are not always consciously understood, these groups do not offer a direct measure of how marriage type and fitness are connected. Quantitative measures of a wide range of variables would be required to draw conclusions about relationships between marriage type

and fitness. These focus group discussions establish the ethnographic context of marriage in this community. From these data, we can make informed predictions about the potential for and avenues through which spouse choice may influence fitness.

4.E. Conclusion

Previous studies attempting to examine the fitness effects of arranged and non-arranged marriage as proxies for limited and free mate choice, respectively, have largely returned null results. This may be due to the oversimplification of marriage type, the overestimation of parent-offspring conflict over mate qualities, the presence of confounding variables affecting both the likelihood of experiencing one type of marriage and reproductive outcomes, and/or the compensatory benefits that arranged marriages provide. From these focus group discussions it is clear that "Who chose your spouse?" does not yield neatly dichotomous answers, and treating responses as such would obscure important variation in this community's spouse-choice dynamics. While parent-offspring disagreement over spouse qualities has been broadly detected in a variety of cultures around the world, these focus groups indicate less disagreement than expected and greater willingness between parents and offspring to compromise. The level of parent-offspring agreement appears higher for men than for women, indicating that women, who are also more likely to experience arranged marriages, may have more limited options in arranged marriages than do men. Thus, any study seeking to understand the fitness consequences of marriage types should first investigate the degree and the sources of parent-offspring disagreement in the community of interest. It is also clear from these discussions that arranged marriages may offer some compensatory benefits, such as increased social, financial, and grandparental support that

could plausibly affect fitness. Added familial financial support in arranged marriages, especially when it comes early in marriage, may lead to differences in the timing of reproduction. In this community the consequences of marrying against parents' wishes appear harsher for women than for men, and thus different fitness effects may be seen depending on whether the bride's, groom's or both sets of parents disapprove of a marriage. Based on these results, it is clear that comparison of arranged and non-arranged marriages is not a clear proxy for limited and free mate choice, as defined by experimental animal studies. Studies seeking to assess the fitness consequences of marriage type will need to consider the potential benefits and costs of those marriage types and the demographic characteristics of individuals in those marriages in order to make culturally appropriate, context-specific predictions.

4.F. References

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Chapter 5: Disparities and Similarities in Parent and Offspring Preferences in an In-Law or Mate

Authored By:

Elizabeth Agey

And

Daniel Conroy-Beam

5.A. Introduction

Perhaps given the communal nature of human reproduction (e.g., Bogin, Bragg, & Kuzawa, 2014; Hrdy, 2006; Kramer, 2010) we should not be surprised that, in a wide array of cultures, parents are heavily involved in selecting a spouse for their offspring. Ancestral-state reconstruction suggests that, throughout human history, marriages arranged by parents may have been the norm (Walker, Hill, Flinn, & Ellsworth, 2011); and cross-cultural studies indicate that parents are involved in their children's spouse choice in 96% of described cultures (Apostolou, 2007). Even in Western industrial contexts, parental approval of a partner is associated with higher relationship quality and stability (Sinclair, Hood, & Wright, 2014; Sprecher & Felmlee, 1992), indicating that parental input is still a salient and arguably functional element of mate choice in contexts where individual choice is paramount. Despite the near ubiquity of parental involvement, the preponderance of the literature on human mate choice has focused on personal preferences for different mate characteristics (reviewed in Stephen & Luoto, 2023). If these individual preferences are adaptive, and if preferences of parents do not match individual offspring's preferences, then parental influence over mating decisions may disrupt sexually selected adaptations and alter fitness outcomes.

Parents and offspring are not expected to fully agree over the ideal traits in an in-law/spouse, respectively. Parents can gain fitness through each of their offspring equally, while offspring gain more through their own reproduction than through the reproduction of their siblings (Trivers, 1974). In addition, parents, due to older age and more experience, may possess additional knowledge than their offspring about the qualities that are important for success in their ecological context. If parent and offspring preferences perfectly align and parents and offspring are equally good at assessing those preferred qualities, then offspring

should be willing to let their parents choose their spouse, but this does not match available evidence. Parent-offspring disagreement was detected in 85% of ethnographies describing cultures with arranged marriage in the Human Relations Area Files database (Agey, Morris, Chandy, & Gaulin, 2021). Parent-offspring disagreements over arranged marriages are also reported as a frequent cause of suicide (Syme, Garfield, & Hagen, 2016), indicating that these disagreements can be profound.

Theoretically, parents should show stronger preferences than offspring for traits in an in-law that could improve their inclusive fitness (Trivers, 1974). For example, parents should be attentive to building alliances, extending trade networks, and improving the family's status/reputation. Offspring, on the other hand, should be more attentive to signs of genetic quality than are their parents, which would be communicated through physical attractiveness. This is compounded because some aspects of physical attractiveness may be genome-specific (e.g., odors indicating MHC dissimilarity, Winternitz, Abbate, Huchard, Havlicek, & Garamszegi, 2017), which would be impossible for parents to assess as effectively as their offspring would.

Previous surveys find that parent and offspring preferences in an in-law/spouse do diverge in these areas. Offspring rate physical attractiveness as more important than do their parents (Apostolou, 2015; Bovet, Raiber, Ren, Wang, & Seabright, 2018; Buunk, Park, & Dubbs, 2008; Hynie, Lalonde, & Lee, 2006; Perilloux, Fleischman, & Buss, 2011), consistent with hypotheses that offspring should prefer traits that increase their own fitness more than that of their parents. Conversely parents place more importance on signs of in-group membership (e.g., similar ethnicity/religion), social status, and family reputation (Apostolou, 2010; Buunk et al., 2008; Perilloux et al., 2011; Tirnanic, 2011), consistent with their

predicted preference for in-laws who can provide benefits more broadly to the family. While these studies show reasonable consistency, there has been less examination of parent and offspring preferences in cultures with arranged marriage, despite these being the contexts in which parents have the highest potential for influencing spouse choice. In one study that focused on an arranged marriage market in China, parent-offspring disagreement was found only for daughters, who preferred physical attractiveness more than their parents (Bovet et al., 2018). Because this study found less parent-offspring disagreement than in non-arranged contexts, more investigation is needed concerning the amount of disagreement over spouse choice in arranged marriage settings.

While there is scope for disagreement between parents and offspring, it should be noted that many studies reveal much overlap between what parent and offspring are seeking in an in-law/mate. Traits like intelligence and ambition are ranked highly by both parents and offspring (Fugère, Doucette, Chabot, & Cousins, 2017), as are kindness and understanding. Other studies have indicated that parent and offspring preferences are more aligned when offspring have more family allocentrism (a multi-item scale measuring feelings of connection with family), which is high in many cultures that practice arranged marriage (Hynie et al., 2006). In focus group discussions in the Nepali community which provided data for this and the previous chapter, parents and offspring both agreed that similarity in caste, family reputation, and being of the right age to marry were important or desirable in a marriage partner (Agey, Crippen, Wells, & Upreti, 2023). Thus, a limited set of divergent preferences may be driving parent-offspring disagreement over spouse choice, and the level of disagreement could depend on the importance of those traits to the parties involved.

To quantify parent-offspring differences in trait preferences, we modified a methodological tool from the wider mate-choice literature. Previous studies investigating *sex* differences in mate preferences have asked participants to work within the constraints of a fixed budget to "purchase" the various traits needed to build an ideal mate (Li, Bailey, Kenrick, & Linsenmeier, 2002). Study participants are instructed that, the more of their budget they spend on a trait, the more of that trait the mate will have; but, in parallel, expenditures on trait A inevitably reduce the amount of traits, B, C, etc. that can be "purchased". By requiring participants to make tradeoffs amongst desirable traits, the method leads participants to reveal the hierarchy of traits that constitute their mating preferences.

As a further refinement, participants are asked to perform the same task with high and low total budgets. In the low-budget condition, participants are more constrained, and thus allocate their budget to the traits they regard as most important (necessities). In higher budget conditions, participants can afford to "purchase" traits that they would like to have (luxuries) once their necessities are met. Previous applications of this method have shown that men and women reveal the greatest divergence in preferences over necessities, but start to exhibit more similar preferences when considering luxuries in a mate (Li et al., 2002). Likewise, parents and offspring may also exhibit different patterns of agreement depending on whether the spouse they are considering fulfills each party's necessities or luxuries.

To examine the differences between parent and offspring preferences in both necessities and luxuries, we collected data on parent and offspring preferences for 14 traits using a two-budget allocation task in which participants built their ideal in-law/spouse. If parents and offspring largely agree over necessities (traits allocated more in the low budget),

then the scope of disagreement may be limited. Conversely, if parents and offspring disagree over necessities, then we should expect significant levels of conflict to emerge. These data were collected in Nepal, which has a long history of arranged marriages, but has recently begun shifting to offspring-selected and co-selected marriages (Ghimire, Axinn, Yabiku, & Thornton, 2006). We examined the "global" differences between parent- offspring preferences across the 14-trait universe by calculating Mahalanobis distances among trait bundles of parents and children, as well as differences in each trait separately using the related measure, Cohen's d. From the existing literature, we hypothesized that parents and offspring would show general disagreement, as well as high levels of disagreement over traits like physical attractiveness (offspring-preferred) and caste (parentally-preferred). Overall, we find support for these hypotheses. In comparing the high and low budgets, we opted for an exploratory approach, and we find that parents and offspring exhibit higher disagreement in the high budget than in the low budget.

5.B. Methods

5.B.i. Study Population

These data were collected in a large community (approximately 20,000 people) in the Dhading District of Nepal. The community is over 80% Hindu, with highest representation coming from Brahmin and Chhetri castes, as well as several ethnic groups (e.g., Tamang, Newar, Magar). This community is primarily agricultural, but individuals living closer to the main highway in town are more likely to run shops or restaurants. As in much of Nepal, the community also receives income through remittances sent from family members living and working abroad. The community is generally well-educated; there are public and private

schools in town, and wealthier families send their children to Kathmandu for school. The literacy rate is approximately 65% (*Nepal Population and Housing Census 2011*, 2012). Following secular trends in educational attainment in Nepal, younger unmarried respondents are more educated than parents. Descriptive statistics for unmarried individuals and parents are in Table 5.1.

Nepal has seen a shift in marriage practices over the last 50 years, with older ages at marriage and fewer arranged marriages (Ghimire et al., 2006), and more focus on love and autonomy (Ahearn, 2001). This shift is reflected in Dhading; approximately 79% of individuals we surveyed said their parents had the most influence on their spouse choice, but this drops to about 56% when limiting the analysis to individuals married within the last 15 years. Dhading society is therefore a context in which both parents and offspring may expect to play a significant role in marriage decisions.

Table 5.1: Descriptive statistics

	Unmarried Sons	Unmarried Daughters	Parents of Sons	Parents of Daughters
N	212	301	Mothers= 142 Fathers= 53	Mothers=110 Fathers=29
Age (in years)	21.5 (3.92)	20.4 (3.08)	46.1 (7.89)	44.0 (7.94)
Education (in years)	11.0 (2.55)	11.8 (1.97)	2.95 (3.79)	3.02 (3.73)
Item Ownership	4.8 (1.07)	4.6 (1.17)	4.5 (1.18)	4.6 (1.16)

Values in parentheses are standard deviations. Item Ownership is based on a checklist of items of increasing value owned by the respondent's household. More item ownership indicates higher socioeconomic status. Values range from 1-7.

5.B.ii. Data Collection

Trained local assistants visited various neighborhoods in the sample area to recruit participants of a wide variety of castes, ethnicities, and socioeconomic statuses. Participants were recruited via a mix of convenience and snowball sampling. We targeted individuals over the age of 16 who were never married (hereafter, offspring) and individuals who had never-married children over the age of 16 (hereafter, parents). Interviews were conducted in private settings of the respondent's choosing.

Offspring were given a budget (consisting of a fixed number of coins) and asked to design their ideal spouse by allocating their coins to the traits (depicted graphically on 14 cards) they found most important in a spouse. Parents were given the same instructions but were asked to build the ideal spouse for a specified unmarried adult child. Participants were told that the more coins placed on a trait card, the more of that trait their ideal spouse/in-law would have. Participants physically allocated the budget by distributing their coins to any or all of the 14 cards listed below [brackets indicate labels that will be used to represent each of these traits in this chapter]:

My spouse should be handsome or beautiful. [Attractiveness]
I should be in love with my spouse. [Love]
My spouse should be the same caste/ethnicity as me. [Caste]
My spouse should be educated. [Education]
My spouse should provide for my kids and me. [Provide for spouse]
My spouse should provide for my parents. [Provide for parents]
My spouse should be kind, caring, and empathetic. [Kind]
My spouse should not drink, smoke, or gamble. [No bad habits]
My spouse should have a good income. [High income]
My spouse should be the same age as me. [Same age]
My spouse should not have affairs. [No affairs]
My spouse should allow me to help make household decisions. [Household decisions]
My spouse should be vigorous and healthy with a lot of energy. [Healthy]
My spouse should be respected in the society. [Respected family]

Each statement above was rephrased appropriately for parents. For example, “My spouse should provide for my parents” was transformed to “My son/daughter’s spouse should provide for me” in the parent version. Visual depictions for each of the 14 traits were selected in collaboration with community members to ensure understandability in the local population. Participants first allocated a budget of 50 coins (high budget), then were asked to redo the task with just 15 coins (low budget). The order of these tasks was consistent across participants. In each case, participants were given a limit of 10 coins per card to ensure that they would allocate coins to more than one trait.

The list of traits was generated by examining previous open-ended interviews and focus group discussions with community members of various ages and sexes in which they were asked to describe the traits that produce a desirable spouse/in-law (Agey et al., 2023). Some additional traits that were not mentioned in discussions were also added due to their theoretical relevance (e.g., physical attractiveness, age). After the task was completed, participants were asked if there were any traits they would prefer that were not listed on cards. 89% of unmarried respondents and 98% of parents did not have any traits to add. The most added traits by both unmarried and parent respondents included “understanding” and “respect for me/my family” (a complete list of traits that respondents said they would add is available in appendix, Table 7.4).

5.B.iii. Analysis

Prior to analysis, data was screened for accuracy. Any respondents whose high and low budget totals were not 50 or 15, respectively, were excluded from further analysis.

To examine overall differences between groups, we calculated Mahalanobis distances (D), which determines the distance between the multivariate means of the distributions of two groups in multidimensional space, where each dimension represents one of the 14 traits. D can be considered an extension of Cohen's d (d) and interpreted in a similar way, with larger values indicating larger differences between groups (Del Giudice, 2019). Mahalanobis D has been used to estimate sex differences in personality (Kaiser, Del Giudice, & Booth, 2020) and mate preferences (Conroy-beam, Buss, Pham, & Shackelford, 2015). To calculate D and get corresponding d values for each trait, we used R code from Del Giudice (2019). For all estimates of D, we also report 95% bootstrapped confidence intervals based on 10,000 samples. To determine which traits drive differences between groups, we examined Cohen's d (d) values for each trait for each comparison. Based on our sample sizes, it is possible that D values can be artificially inflated, so all values of D and d reported in the remainder of the paper are bias-corrected (Del Giudice, 2019).

We calculated D estimates separately for each type of parent-offspring dyad (daughter-mother, daughter-father, son-mother, son-father) and separately for the high and low budgets. However, due to low variation in the low budget, we were not able to compute reliable confidence intervals for our sample of fathers of daughters. To address this, we combined data from mothers and fathers to create groups for parents of daughters and parents of sons for both the high and low budgets. These parent-son and parent-daughter values are reported alongside estimates for mothers and fathers separately. Because sex differences have been the dominant focus of the human mate-choice literature, we also calculated D between unmarried men and women in the community as a baseline for gauging the magnitude of

parent-offspring differences. Although this is not the focus of this paper, Cohen's d values for the sex difference are available in the appendix, Table 7.2.

5.B.iv. Addressing assumptions of normality

Because calculations of overlap and heterogeneity based on D can also be inaccurate if data are not normally distributed in multivariate space, we attempted to assess multivariate normality in the data. We visually inspected normality by examining density plots for each variable, which are available in the appendix (Figure 7.1). We also attempted to statistically test multivariate normality. Based on Mardia's test, none of the data were normally distributed in multivariate space. To assess whether power transformations on the data would help achieve multivariate normality, we used the powerTransform function from the car package (Fox & Weisberg, 2019) to explore various Yeo-Johnson transformation options. For the high budget, no transformations would bring the data closer to normality than simply using the original data. For the low budget, each variable returned a radically different power transformation to bring it into a normal distribution. While this would allow the estimates of overlap to be more accurate, the interpretation and meaning may be lost with the number of required transformations. Thus, we use the raw data for all calculations of D with bootstrapped confidence intervals. We also report the amount of overlap between distributions, but interpret them with caution, especially for the low budget calculations, due to non-normality. The density plots for the low budgets, rather than the overlap estimates, better show overlap between groups.

5.C. Results

5.C.i. Descriptive Statistics

Table 5.2 shows the mean allocation of coins to each trait card for sons, daughters, and parents (separate means for mothers and fathers are reported in the appendix, Table 7.2). To compare the high and low budgets, we converted the coins allocated into a percentage of the budget by dividing by 50 (for the high budget) or 15 (for the low budget), as shown in Figure 5.1.

Table 5.2: Mean coin allocation by group, trait, and budget.

	High Budget				Low Budget			
	Daughters		Sons		Daughters		Sons	
Trait	O	P	O	P	O	P	O	P
No Affairs	3.91	3.68	4.75	3.94	1.05	0.94	1.42	1.13
Same Age	1.91	2.48	1.93	2.23	0.41	0.36	0.34	0.35
No Bad Habits	3.89	4.19	3.56	4.16	1.22	1.15	0.92	1.17
Attractiveness	4.03	2.96	4.65	3.29	1.21	0.72	1.68	0.82
Same Caste	2.27	4.30	2.18	3.83	0.66	1.83	0.77	1.54
Household Decisions	2.98	2.71	2.54	2.99	0.64	0.51	0.62	0.51
Educated	3.79	3.99	3.4	3.50	1.05	0.76	0.78	0.82
Healthy	3.19	2.92	3.31	3.49	1.04	1.46	1.09	1.45
High Income	4.86	4.09	3.47	3.37	1.39	0.55	0.56	0.47
Kindness	3.05	3.47	3.17	3.72	0.66	0.66	0.73	0.57
Love	5.03	4.24	5.82	3.87	1.64	1.06	1.97	0.98
Respected Family	4.3	4.32	4.67	4.59	2.12	3.62	2.15	3.77
Provide for Spouse	3.83	3.97	2.95	3.53	1.13	0.91	0.79	0.74
Provide for Parents	2.96	2.69	3.61	3.48	0.77	0.45	1.16	0.68

O=Offspring, P=Parent

In the high budget, the trait with the highest mean allocation for sons and daughters was love (avg. coins: sons=5.82, daughters=5.03), followed by high income for daughters (avg. coins=4.86) and no affairs by sons (avg. coins=4.75). The highest allocations for parents in the high budget were for a respected family (avg. coins: parents of daughters=4.32, parents of sons=4.59), followed by caste for parents of daughters (avg. coins=4.30) and no

bad habits for parents of sons (avg. coins=4.16). The lowest ranked trait in the high budget for all parties was same age. In the low budget, all groups allocated the highest percent of the budget to a respected family, followed by love for daughters and sons (avg. coins: daughters=1.64, sons=1.97) and same caste for parents (avg. coins: parents of daughters=1.83, parents of sons=1.54). Same age was, again, allocated the fewest coins by all groups in the low budget.

We then calculated the percent change from the low to high budget for each trait. Allocating a larger percentage of the budget to a trait in the low budget indicates the trait is a necessity in a mate/in-law while a larger percentage of the budget allocated to a trait in the high budget indicates a luxury in a mate/in-law. Items with similar percentages allocated in the high and low budgets are neither necessities nor luxuries. We compared the percentage allocated in the high and low budgets using t-tests with a Bonferroni correction for multiple comparisons (Figure 5.1). For all groups, a spouse from a well-respected family was the highest ranked trait in the low budget, and it was given a significantly higher percentage of the budget in the low budget task in all groups except fathers of daughters. This could be because being from a well-respected family is a cue of other qualities, like high income, good behavior, and/or caste; thus, in a constrained budget, it is an avenue to procure multiple desired traits at once. For all types of respondents except fathers of sons, finding a partner of a more similar age was a luxury. Fathers and mothers of daughters spent more on high income in the high budget, indicating that this trait is a luxury. High income was also a luxury for sons and parents of sons. Finding a daughter-in-law that was kind was a luxury for parents of sons, mothers of daughters, and daughters. Mothers of both sons and daughters

also considered someone who would provide for them and for their children/grandchildren as luxuries. All other percentage changes between the high and low budgets are non-significant.

Figure 5.1: Mean percent allocated in low and high budgets by type of respondent

Bonferroni-corrected p-values: *p<.05, **p<.01,***p<.001

5.C.ii. Mahalanobis Distance Calculations

Rather than examining each trait as a separate comparison, we assessed the differences between groups incorporating ratings for all 14 traits at once by calculating the Mahalanobis Distance (D) between parents and offspring. To help visualize these differences, Figure 5.2 plots the Mahalanobis distances in two-dimensional space, with larger distances between labels indicating larger differences in preferences across all traits. Table 5.3 reports all values of D, the associated heterogeneity coefficients, overlap estimates, and probabilities of correct classification for each comparison. Figure 5.3 plots Cohen's d values for each trait in each comparison individually, and a table of these values can be found in the appendix (Table 7.3).

Table 5.3: Mahalanobis distance (D) results

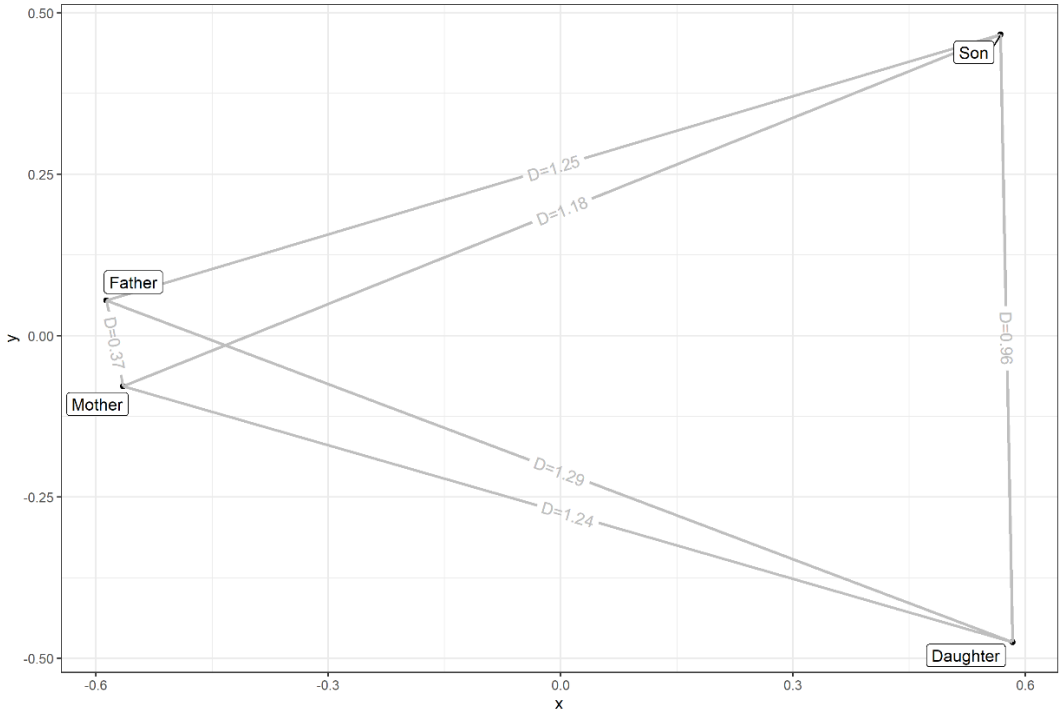
	Dyad	D	CI	OVL	OVL2	H2	PCC
High Budget	Parent-Daughter	1.27	1.01-1.40	0.53	0.36	0.59	0.74
	Mother-Daughter	1.24	0.93-1.37	0.54	0.37	0.66	0.73
	Father Daughter	1.29	0.72-1.50	0.52	0.35	0.56	0.74
	Parent-Son	1.25	0.93-1.42	0.53	0.36	0.77	0.73
	Mother-Son	1.18	0.83-1.34	0.56	0.39	0.72	0.72
	Father-Son	1.25	0.83-1.43	0.53	0.36	0.77	0.73
Low Budget	Parent-Daughter	1.01	0.69-1.15	0.61	0.44	0.72	0.69
	Mother-Daughter	1.02	0.69-1.19	0.61	0.44	0.70	0.70
	Father-Daughter	1.08	NA	0.59	0.42	0.78	0.70
	Parent-Son	0.84	0.55-0.95	0.68	0.51	0.70	0.66
	Mother-Son	0.86	0.50-0.99	0.67	0.50	0.70	0.67
	Father-Son	0.93	0.34-1.09	0.64	0.47	0.76	0.68

D represents the bias-corrected Mahalanobis Distance. CI is the 95% bootstrapped confidence interval (could not be calculated for father-daughter dyads in the low budget). OVL and OVL2 represent two estimations of overlap. H2 is the heterogeneity coefficient, with 0 indicating that all variables contribute equally to group differences and 1 indicating just one variable contributes to group differences. PCC is the Probability of Correct Classification, or the chance that a randomly selected individual would be correctly classified in their group.

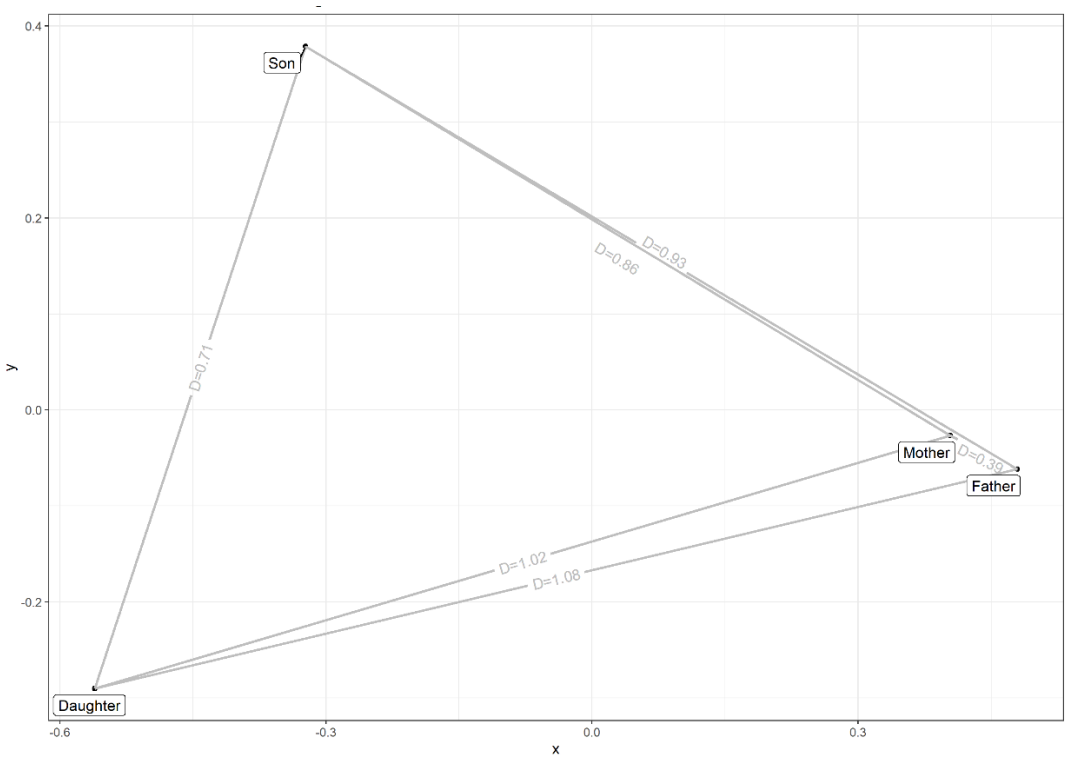
Figure 5.2: Two-dimensional representation of Mahalanobis distances in the high (A) and low (B) budget allocation tasks.

Larger distances between labels represent larger disparities in preferences between those groups.

A.



B. Mahalanobis distance, Low budget



High Budget

In the high budget, the Mahalanobis distance in preferences between parents and daughters was 1.27 (CI: 1.01-1.40), and the difference in preferences between parents and sons was 1.25 (CI: 0.93-1.42). The highest D value (most disagreement) when separating by parent's gender was 1.29 (CI: 0.72-1.49), which described the difference between daughters' and fathers' preferences. The lowest D value, indicating the lowest disagreement, was 1.18 (CI: 0.83-1.34) for the preferences of mothers and sons (Figure 5.2). As a point of comparison, the difference between unmarried men and women has a D value of .96 (CI: 0.71-1.07), meaning that the lowest amount of parent-offspring disagreement is greater than the disagreement between men and women in this community, although it should be noted that these estimates have overlapping confidence intervals. This is an important baseline, since so much of the mate-choice literature has focused attention on the differences between the preferences of women and men.

Heterogeneity coefficients range from 0.56 (for fathers and daughters) to 0.77 (father-son and parent-son dyads). These values indicate that differences in only a few traits are driving the differences between groups, rather than differences in each trait contributing equally. Investigating the Cohen's d values for each trait in each comparison (see Figure 5.3), the largest d values (most disagreement) across all comparisons are produced when examining caste (daughters: d=1.03, sons: d=.81). The positive values of d indicate that parents value this trait more than offspring. Offspring, on the other hand, often place more value on physical attractiveness than do parents (daughters: d= -0.58, sons: -0.56). Sons also placed much more value on loving their future spouse than did their parents (d=-0.87), but this disagreement was not as pronounced for daughters and their parents (d=-0.37). While

sons valued love much more than parents, it should be noted that parents highly valued love, and generally placed as many coins on love as they did on caste (see Figure 5.4). Sons also preferred more than their parents partners who would not have affairs (d=-0.35), while daughters and parents showed more agreement (d=-0.12). Daughters, on the other hand, were more attentive to partners with high income than were their parents (d=-0.34), but sons and parents showed more agreement over income (d=-0.05). While most parents and daughters agreed on finding a spouse who could provide for their partner and children (d=0.07), parents valued this more than sons did (d=0.30). Overall, all parent-offspring dyad types agreed that finding a partner who was kind, educated, and well-respected in society was equal in importance.

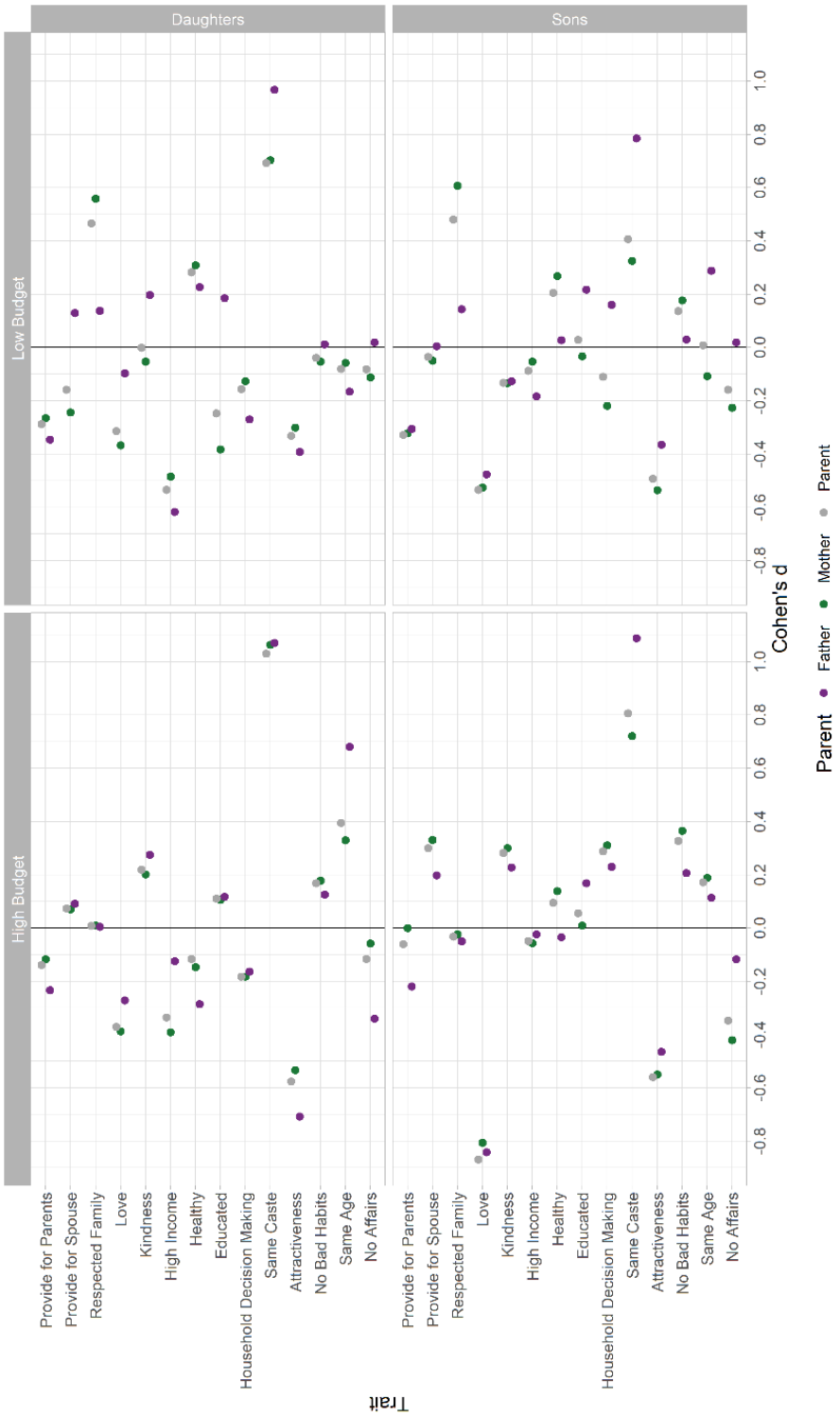
Low Budget

In the low budget, the Mahalanobis distance in preferences between parents and daughters was 1.01 (CI: 0.69-1.15), and the difference in preferences between parents and sons was 0.84 (CI: 0.55-0.95). Separating parents by gender, the highest D was 1.08 for fathers and daughters; however, because of a low sample size and little variation in responses, we were unable to calculate a confidence interval for this dyad. The lowest value of D was 0.86 (CI: 0.50-0.99) for mothers and sons (Figure 5.2). Across all groups, the values of D were lower in the low budget than in the high budget, indicating more agreement over traits that are necessities in an in-law/spouse. In the low budget, daughters and parents also tended to disagree more than sons and parents.

In the low budget, caste, again, was the trait that produced the most disagreement, with parents preferring individuals of the same caste/ethnicity more than offspring

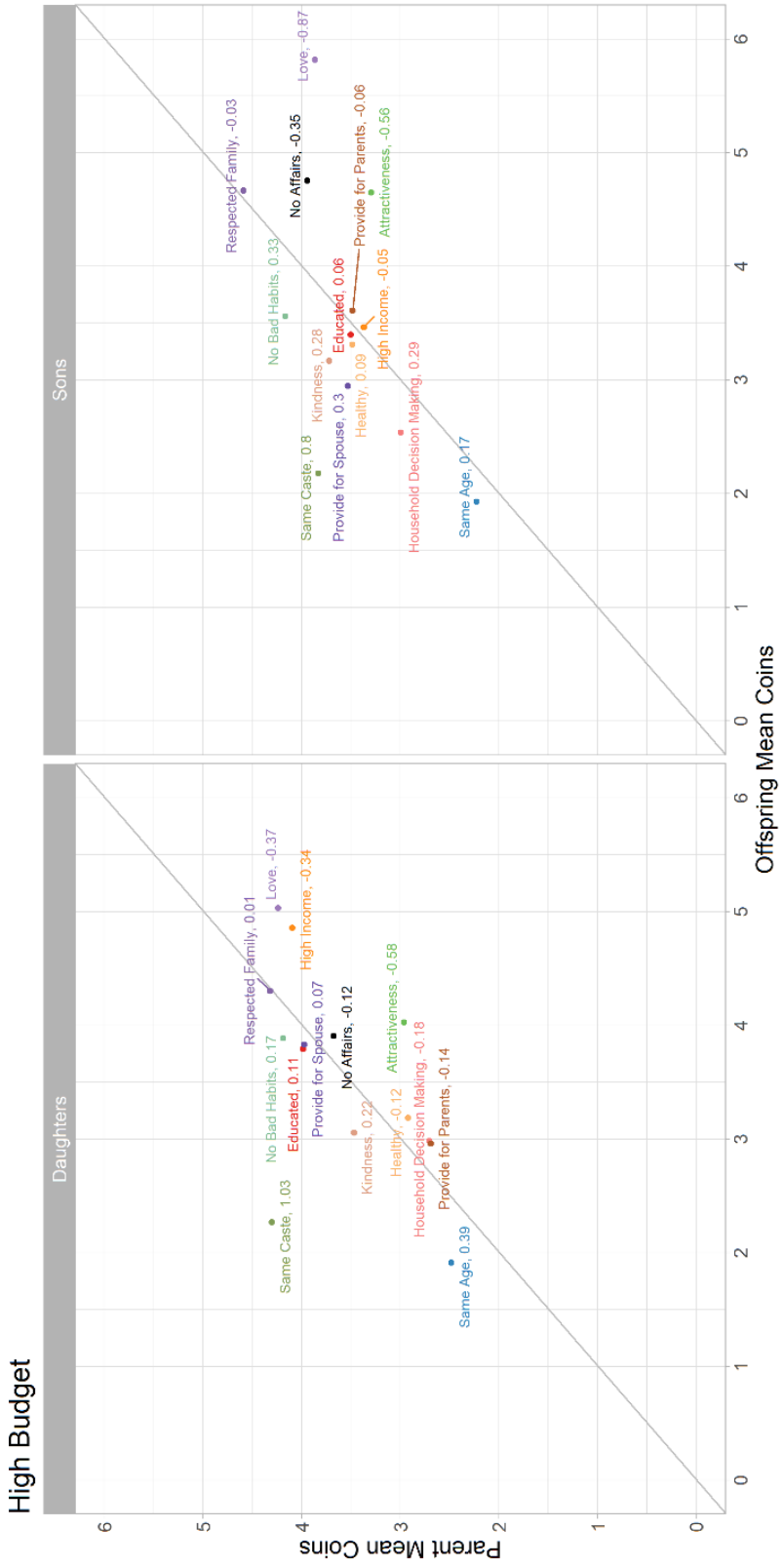
(daughters: d=0.69, sons: d=0.41). Offspring, again, showed greater preference for physical attractiveness than their parents did (daughters: d=-0.33, sons: d=-0.49). In the low budget, daughters again show higher preference for high income than do their parents (d=-0.54), but this disagreement is absent for sons and parents (d=-0.09). Parents show higher preference for individuals from well-respected families than do offspring (daughters: d=0.47, sons: d=0.48), which is a difference that was not seen in the high budget comparisons. However, both parents and offspring allocate the highest number of coins to this trait in the low budget, indicating that they both highly value it. Education was similarly valued by parents and offspring in the high budget (but slightly more favored by parents), but in the low budget daughters valued this trait more than their parents did (d=-0.25). Surprisingly, finding a spouse who can care for their parents is also more important to offspring than to parents (daughters: d=-0.29, sons: d=-0.33). Parents and daughters largely agreed on traits such as kindness, refraining from bad habits, finding a spouse of a similar age, and not having affairs. Parents and sons largely agreed on finding a spouse that will provide for their partner and children, has a good education, and is of a similar age.

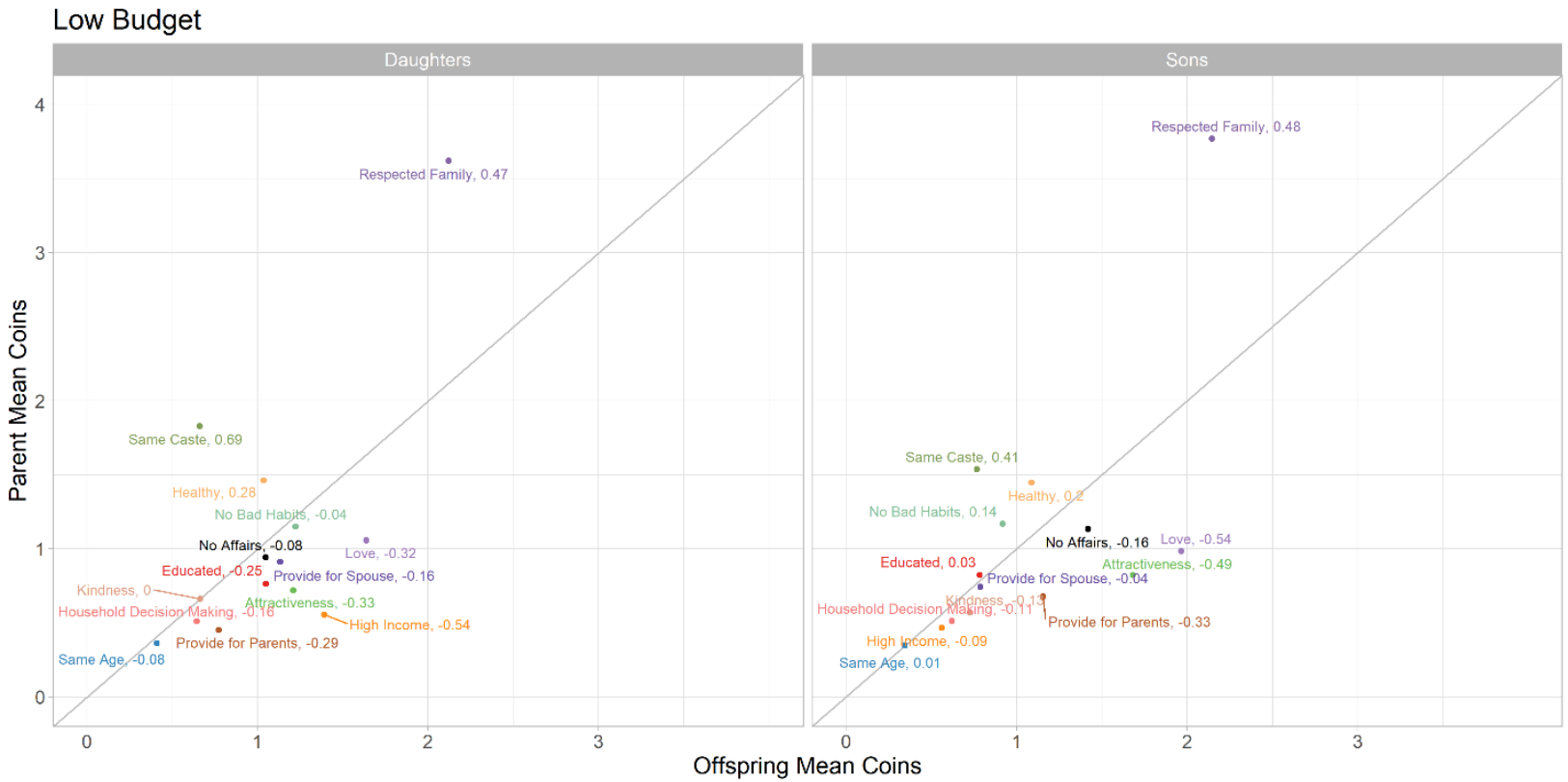
Figure 5.3: Cohen's d values for divergence in parent-offspring preferences for each trait



Vertical line indicates a Cohen's d of 0, or no difference between parent and offspring preferences. Values to the left of the vertical line indicate that offspring prefer the trait more and values to the right indicate that parents prefer the trait more.

Figure 5.4: Mean coins allocated by parents and offspring for each trait, labelled with Cohen's d values measuring the distance between parents and offspring.




Low Budget
Daughters
Sons
Parent Mean Coins
Offspring Mean Coins
0
1
2
3
4
Respected Family, 0.47
Same Caste, 0.69
Healthy, 0.28
No Bad Habits, -0.04
No Affairs, -0.08
Love, -0.32
Educated, -0.25
Provide for Spouse, -0.16
Kindness, 0
Attractiveness, -0.33
Household Decision Making, -0.16
High Income, -0.54
Provide for Parents, -0.29
Same Age, -0.08
Respected Family, 0.48
Same Caste, 0.41
Healthy, 0.2
No Bad Habits, 0.14
No Affairs, -0.16
Love, -0.54
Attractiveness, -0.49
Educated, 0.03
Provide for Spouse, -0.04
Kindness, -0.13
Household Decision Making, -0.11
Provide for Parents, -0.33
High Income, -0.09
Same Age, 0.01

5.D. Discussion

Parents and offspring in Nepal generally do not closely agree on the ideal qualities in an in-law/spouse, in line with predictions derived from parent-offspring conflict (Trivers, 1974) and previous research on parent-offspring disagreement over mate choice (Agey et al., 2021; Apostolou, 2015; Bovet et al., 2018; Perilloux et al., 2011). The discordance in parent and offspring preferences in this community is higher than the discordance between women's and men's preferences, indicating that these are not minor parent-offspring differences. To the extent that they are acting on their own preferences, parents arranging marriages in this society may be selecting partners for their children who do not match their children's ideal preferences. Likewise, offspring who select their own spouses may not meet their parents' preferences for an in-law, leading to disagreements in the spouse-selection process.

This two-tiered analysis indicates that parents and offspring tended to agree more on necessities in an in-law/spouse (the low-budget condition) than on luxuries (the high-budget condition). If disagreements are more frequent over less-important traits, then actual conflict may be less severe than when disagreements occur over the most important traits. The most highly valued trait in the low budget for both parents and offspring was choosing someone from a well-respected family, which could be an indication that the individual has several other desirable traits, like good income or behavior. In the low budget, parents and offspring also agreed on the traits that were relatively unimportant in a partner (i.e., were not allocated a large percentage of the budget), such as similar age, and ability to make household decisions. This means that parents and offspring agree on many of the essential traits a spouse should have.

In line with previous surveys, our results also demonstrate that parents show higher preferences for similar caste/ethnic backgrounds than do offspring while offspring show higher preferences for physical attractiveness than do their parents. This disagreement was consistent across high and low budgets. This invariance suggests that the disagreements may be over fitness-relevant traits. Offspring unable to achieve an acceptable level of physical attractiveness in a parentally-chosen spouse may miss out on important genetic benefits of mate choice. Parents unable to choose in-laws from the right caste/ethnicity may miss out on the associated social or economic benefits derived from those alliances, and this loss could presumably affect other members of the family.

If these preference disparities result in different types of fitness-relevant traits being selected in arranged and non-arranged spouses, then arranged and non-arranged marriages should exhibit different fitness outcomes. However, repeated studies have found no or minimal fitness differences between arranged and non-arranged couples (Hasnain, 2020; Sorokowski et al., 2017) or women (Chapter 3, this dissertation). This, then, presents a puzzle—if mate preferences evolved to increase fitness in their bearers, and parents and offspring systematically prefer different types of individuals, why do arranged and non-arranged couples have such similar fitness outcomes? When opting for arranged marriages in which parents select in-laws that will maximize socioeconomic benefits, offspring may be weighing these benefits against the genetic benefits of individual spouse choice. If these tradeoffs are fairly equal, then this may help explain the lack of fitness differences based on marriage type. In cases where offspring and their parents are able to cooperatively choose a spouse that they both find acceptable, these couples may obtain both the genetic fitness

benefits of mate choice in addition to the socioeconomic benefits of parental mate choice, producing the best outcomes.

Previous focus groups conducted in the same population indicated that daughters would face more parent-offspring disagreement than sons (Agey et al., 2023), and our results indicate that this is the case, although the difference in parent-offspring disagreement by sex is very minimal. This mirrors other results showing more parent-offspring disagreement for daughters in arranged marriage contexts (Bovet et al., 2018). This additional disagreement is interesting because cross-cultural tabulations indicate that women are more likely to have arranged marriages than men (Broude & Greene, 1983). This could mean that women are less likely to achieve their mate preferences in arranged marriages compared to men. In addition, women face higher sanctions for adultery and have little opportunity for remarriage in this community. Thus, women should be more likely to have fitness reductions in arranged marriages in-line with the observed fitness reductions of limited mate choice in experimental studies. However, because women in this context also face greater social and financial sanctions for marrying against their parents' wishes than men do (Agey et al., 2023), this may produce stronger tradeoffs between the potential genetic fitness benefits of independent mate choice and the social or financial benefits of arranged marriages for women in this community.

The results of this analysis somewhat contradict previous ethnographic data from the same area (Agey et al., 2023). In focus groups in this community surveying similar demographic groups, offspring stated that caste was important to them in a partner. However, examining their budget allocations in this study, they do not place as much weight on it as expected from their focus-group statements. Likewise, unmarried men highly valued physical

attractiveness in their budget allocations, but in focus groups they repeatedly stated that attractiveness should not be a priority. The divergence between stated preferences in focus groups and the budget allocation task deserves attention. This discrepancy could be an attempt to increase social desirability or reflect parentally dominated societal norms about what a good spouse should be in focus groups where peers are present. However, it could also offer insight into the ways in which these disparities in preferences are negotiated by parents and offspring in actual spouse choice scenarios. By acknowledging and valuing the preferences of the opposite party (including in public settings where people may gossip), parents and offspring may be given more opportunities to express their opinions and exhibit more choice in spouse selection than would be offered if they openly expressed opposition. Statements from previous focus groups indicate this is a potential strategy; for instance, this mother discussed talking to her children as a friend to increase her ability to assess the offspring's self-chosen partner:

> "If my son or daughter are in love with someone then I will ask them if they want to get married to them. As parents, we need to know what kind of people they are, if they have any bad habits and if they are perfect for my kids or not. We do all kinds of questions and answers and try to find out as much as we can. When we talk with our daughters regarding their partners, we try to be very frank and talk with them like their friends."

The disparate preferences of parents and offspring may also be negotiated by third-parties, such as a matchmaker, who, in Nepal, is often an extended family member recruited by

parents to search for potential spouses. For instance, this quote from an unmarried women in a previous focus group shows a matchmaker appealing to offspring preferences for attractiveness:

> "When the *lami* [matchmaker] comes to our house then he will say that there is a guy in another village who is handsome, educated, and blah blah blah. He keeps on praising the guy and his family. He tells [our parents] that your daughter is also mature enough to get married and they will be a good match for each other. And if our parents like the guy then they will marry us to the guy. I mean of course, we have to like him as well first."

If, as these quotations indicate, parents and offspring are aware of each other's disparate preferences, consider these preferences in spouse choice decisions, and make attempts to negotiate over these traits, then offspring may often end up with marriage partners that are acceptable to both parents and offspring, even in arranged marriages. This dynamic has been observed in other contexts (Apostolou, 2009), and recent work shows more concordance between parents and offspring in actual mate selection than in stated preferences (Fugère, Ciccarelli, & Cousins, 2023). Marriages in which parents and offspring are able to negotiate and find partners that meet the preferences of both parties may simultaneously satisfy parental and offspring interests. Future studies of the effect of spouse choice on fitness outcomes in arranged marriage contexts should thus measure spouse choice via multiple dimensions of parent and offspring choice in the process, including the degree to which they negotiated each other's preferences.

5.E. Limitations

Because parents and offspring were sampled separately, and not from matched parent-offspring dyads, our measures of disagreement may be biased. If the parents and offspring recruited were systematically different, then there may be more or less agreement in actual parent-offspring dyads. To circumvent this, we recruited parents and offspring from similar neighborhoods. However, different sampling and recruitment methods could return different results.

Certain groups were undersampled in this data set, especially fathers of daughters. Multiple factors contributed to this: Men are more resistant to participation in this region, men are more likely to live outside of the community (within Nepal or abroad), and women marry earlier than men, meaning that parents are more likely to have unmarried sons than unmarried daughters. We attempted to circumvent this by revisiting neighborhoods outside of working hours and on holidays, when men are more likely to be home, but men were still difficult to recruit. This required us to combine data for fathers and mothers in our analyses. While mothers are overrepresented in this data set, this may still be a reliable measure of parent-offspring disagreement because mothers are typically the most involved in the initial selection of a spouse in this community. Mothers more frequently do the initial screening of potential spouses and consult extended kin networks to find eligible matches. Thus, the preferences of mothers may play a larger role in spouse selection than do the preferences of fathers.

The calculations of overlap and percentage of correct classification rely on multivariate normality, but multivariate normality can be difficult to assess, particularly when

sample sizes or variation is low. While assessments of the high budget data indicated that there were no transformations that would get closer to normality than the raw data, the low budget is much less normal. Therefore, overlap estimates should be read with caution, especially for the low budget comparisons, and density plots should instead be used to estimate overlap in preferences for particular traits.

In addition, many of the traits used in this study may be correlated. For example, ratings of attractiveness in the Tsimane are positively associated with other traits like social status, wealth, and trustworthiness (Rucas et al., 2006). Similar correlations between the 14 traits used in this study likely exist. In particular, high allocation to "respected in society" in the low budget allocation may indicate that this trait is a proxy for other desirable traits, like caste or income. Likewise, "love" was provided as a trait option in this study based on qualitative descriptions of an ideal spouse by community members; however, love may be the result of obtaining desired traits in a partner rather than a trait inherent to a potential partner.

5.F. Conclusion

Parents and offspring in Dhading, Nepal do not fully agree over the ideal traits in an in-law/spouse and show especially strong disagreement over potentially fitness-relevant traits like physical attractiveness and caste, which serves as a marker of in-group membership in this context. Since parents and offspring systematically disagree over spouse choice decisions, then parental choice should inhibit evolved individual mate choice algorithms, and fitness should be reduced in arranged marriages. However, the existing studies on fitness outcomes in arranged and non-arranged marriages have not shown the expected fitness

differences. This puzzling result indicates that individuals might be assessing tradeoffs between genetic fitness benefits of individual mate choice and the socioeconomic benefits of arranged marriages, leading to similar fitness outcomes via different pathways. This may be especially true for women, who appear to face more disagreement with their parents over the ideal qualities in a mate, but also face stronger sanctions for eloping. Thus, it is also important to further consider how gender affects the degree of disagreement and/or choice in arranged marriage contexts. Parents and offspring may make attempts to negotiate to find spouses that appear to both of their preferences in real spouse choice decisions. The consideration of the larger social and family structure in mate choice decisions demonstrates the importance of social cohesion and cooperation in human mate choice, and future studies of mate preferences should consider the role of parents and other kin in mate selection.

5.G. References

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Chapter 6: Conclusion: The landscape of human mate choice

Authored by:

Elizabeth Agey

This dissertation aimed to investigate whether comparison of arranged and non-arranged marriages is an appropriate proxy to test the function of evolved mate preferences in humans by examining several essential steps that this argument hinges upon. Across the chapters in this dissertation, we find that parents and offspring generally show disagreement over the ideal spousal traits in arranged marriage contexts, indicating that arranged and non-arranged marriages can produce variation in expression of evolved mate preferences. However, these different mate-choice criteria do not lead to different reproductive outcomes in arranged and non-arranged marriages. This could be because arranged and non-arranged marriages offer different types of benefits that increase fitness equally but through alternative pathways: Parentally chosen marriages may offer substantial socioeconomic benefits while offspring-chosen marriages may offer substantial genetic benefits. By this logic, fitness outcomes may actually be maximized when parents and offspring cooperate in spouse selection to find partners that meet both parent and offspring preferences, and this cooperation could occur in both the arranged and non-arranged marriage categories. When thinking about the evolutionary function of mate preferences, it may be more accurate to classify parental and offspring preferences as both contributing to fitness, rather than being in direct opposition. This dissertation opens several other interesting pathways for future research on human mate choice.

6.A. Discussion of Main Findings

In order for arranged marriage to be an appropriate proxy for limited mate choice, parents and offspring must on average choose different types of individuals as in-laws or spouses, respectively. This dissertation suggests that they do. Chapter 2 uses cross-cultural

ethnographic data from the Human Relations Area Files to establish that, in all world areas, parents and offspring prefer different individuals in arranged marriages, and that there are cross-cultural consistencies in the traits that parents and offspring object to in a potential spouse. These data indicate that these different preferences sometimes produce strong actions in response to disagreements, like ostracism, financial sanctions, physical violence, and suicide. Chapter 5 quantitatively examines parent-offspring preferences in Nepal, finding substantial overall differences in their preferences, especially driven by parental preferences for similar caste/ethnicity and offspring preferences for physical attractiveness. While Chapter 4, based on qualitative data from focus groups, shows much stated agreement over in-law/spouse characteristics, Chapter 5 demonstrates that these stated preferences do not match ideals estimated from the budgets allocated to characteristics in an ideal in-law/spouse. As in previous surveys (Bovet, Raiber, Ren, Wang, & Seabright, 2018; Guo, Li, & Yu, 2017; Perilloux, Fleischman, & Buss, 2011) and in Chapter 2, parents and offspring seemed to disagree most over traits like caste/ethnicity, a sign of group membership and status preferred by parents, and physical attractiveness, a sign of genetic quality and/or compatibility preferred by offspring. This indicates that parental mate choice in arranged marriage might reduce the genetic benefits of mating while independent offspring mate choice may reduce group membership benefits, both of which are important for fitness.

Across cultures, women are more likely than men to have parents involved in their spouse choice (Apostolou, 2007; Broude & Greene, 1983). This dissertation indicates that women may also face more parent-offspring disagreement over mate preferences and face stronger punishments for marrying against parental wishes. In Chapter 4, women discuss disagreement with their parents (especially their fathers) over the behavior of a potential

spouse and over physical attractiveness. Likewise, Chapter 5 shows less overlap in mate preferences between parents and daughters than between parents and sons, and this was more pronounced when budgets were constrained, indicating that parent-daughter disagreement is stronger over necessities in a partner than is parent-son disagreement over necessities. Chapter 4 also describes differential sanctions for marrying against parental wishes for daughters and sons, with daughters facing stricter punishments for elopement, like ostracism from their family. Together these lines of evidence indicate that women's fitness may be more affected by marriage type than men's fitness.

With parent-offspring disagreement in this context established, especially for women, it should be reasonable to expect fitness to vary in parallel with independence of mate choice. However, Chapter 3 does not show any differences in offspring survival or birth timing between women in arranged and non-arranged marriages in Chitwan, Nepal. These similar reproductive outcomes persist even after separating marriages that are co-selected by both parents and offspring into a third mate choice category, which has not been done in previous tests. These results are not in line with several of the findings of experimental animal studies showing that randomly assigning a mate often leads to poorer offspring survival and longer interbirth intervals than allowing animals to exercise free mate choice. This seemingly paradoxical result indicates that human mating is fundamentally different from the mating systems of the animals used in lab experiments. Several of these differences are illuminated below.

Parental involvement in spouse choice is tied to additional benefits that may compensate for not choosing a partner individually, as evidenced by findings presented in Chapter 4. These benefits of parentally selected marriages include better family and

community relationships, increased gift-giving/financial support, and increased desire to invest in grandchildren. In addition, parents may offer wisdom about the spouse qualities that will increase success in their ecology, and incorporating parental wisdom into spouse choice decisions could be beneficial for offspring fitness outcomes. Arranged marriages may thus represent one side of a trade-off between the social, economic, and knowledge-based benefits of parental choice and the genetic benefits of individual choice, which may simply maximize fitness in different ways. These socioeconomic benefits of arranged marriage are especially salient for women, who face stricter punishments for elopement; thus, despite women experiencing more disagreement with their parents over mate preferences, they may choose to let their parents influence their spouse choice if the socioeconomic benefits are more substantial. This may partially explain why arranged marriage is cross-culturally more common for women than for men and offer insight into the null results of Chapter 3.

The benefits provided by parental choice and the benefits provided by individual choice are not mutually exclusive, and families that are able to cooperate to choose a spouse may be able to simultaneously obtain the genetic and socioeconomic benefits of mate choice. Accordingly, the focus group discussions in Chapter 4 indicated a high willingness from parents and offspring to discuss spouse choice decisions and a desire to find an in-law/spouse that is acceptable to both parties. Previous evidence indicates that parents and offspring desire spouses that are acceptable to each other (Apostolou, 2009), shows more concordance on actual spouse selections than on stated ideals (Fugère, Ciccarelli, & Cousins, 2023), and demonstrates that parental approval of a match can improve marital outcomes (Felmlee, 2001; Sinclair, Hood, & Wright, 2014; Sprecher & Felmlee, 1992). Additionally, parents and offspring in Chapter 5 showed more agreement over spouse characteristics when budgets

were constrained, indicating that there may be more agreement over which traits are fundamentally important (and which are fundamentally unimportant, as measured by low budget allocation by both parties). This presents an avenue for parent-offspring collaboration in spouse choice decisions in arranged marriage contexts. If such collaboration is common, even in arranged marriages, then the single-question measure of spouse choice in the CVFS data set is probably not sufficient to differentiate between parental and offspring choice.

There is likely to be variation in the potential for parent-offspring disagreement in spouse choice decisions. There is much individual variation in mate preferences, and some individuals may simply align better with their parents' desires. Individuals whose mate value is low and are unable to find mates independently may have better chances of finding a partner under parental choice, in line with several statements from the focus groups in Chapter 4. Conversely, individuals from families with low social connectedness may have less incentive to enter arranged marriages. For example, individuals from low-income families who cannot arrange marriages with individuals from higher-status families may not stand to gain many socioeconomic benefits from arranged marriages, and thus they may opt for offspring-led mate choice. Education may be one avenue through which individuals, via improved self-sufficiency and hence higher value in the mate market and negotiating power with parents, are also able to bargain for more independence in choosing a spouse (Schaffnit et al., 2022). Thus, for well-educated individuals in Nepal, parents may be satisfied with their offspring's mate choice more frequently, reducing overall disagreements. Furthermore, in rapidly changing environments where the lifestyle of offspring is not expected to resemble the lifestyles of their parents, offspring may have better ecological knowledge than their parents and be able to choose better mates than parents would. In these situations, parents

may open the door for offspring to exhibit more choice, even within arranged marriages. Nepal has gone through rapid change over the last 50 years and many Nepali people have immigrated to other countries, where their lifestyles are radically different than their parents'. Accordingly, Nepali arranged marriages now heavily incorporate offspring preferences, with many parents simply introducing potential spouses while allowing offspring to determine which options are best suited to them.

6.B. Limitations

Testing whether independent mate choice enhances fitness in arranged marriage context relies on appropriate measurements of offspring and parental influence over spouse selection. The few previous tests of this hypothesis in arranged marriage systems treat arranged and non-arranged marriage as a binary variable (Hasnain, 2020; Sorokowski et al., 2017), but each of those categories can encompass a range of offspring and parental choice. Chapter 3 of this dissertation was able to include three categories of spouse choice—arranged, co-selected, and self-selected—still finding no fitness differences between these three categories. It is likely that these three categories, based on a single survey question, are still not adequately precise measures of the degree of offspring and parental choice. In Chapter 4, arranged marriages were described as cases where parents found the spouse, regardless of the amount of choice the offspring exhibited. Thus, "arranged marriages", as measured in Chapter 3, could include marriages where parents unilaterally chose a spouse for their child with zero offspring input, and it could include cases where parents pre-approve several spouse options and allowed their child to choose between them. These are different levels of offspring mate choice that need to be accounted for to properly test whether limited

mate choice reduces fitness in humans. Thus, future studies will need to divide marriages into more categories (or devise appropriate scales), differentiating between cases in which offspring have zero input into their spouse choice and cases where offspring have some influence over parental choice. Such index measures should account for variables like: who initially found the spouse, whether parents and offspring presented potential spouses to each other, whether offspring met parentally-chosen spouses prior to engagement, and whether either party had veto power over the other's choice. Researchers may also consider examining differences in the pools of potential candidates that parents and offspring each consider, and the degree of overlap between them to determine whether the candidates parents or offspring choose are more likely to be acceptable to both parties. Measuring spouse choice in this more continuous and dynamic way will allow for better testing of the fitness effects of parent and offspring mate choice, as well as other outcomes like marital satisfaction, child wellbeing, mental health outcomes, etc. Because this dissertation used a preexisting data set to test the hypothesis, creating a measure of choice based on input at several stages of marriage was not possible; however, future analyses based on the data I collected in Dhading, Nepal could measure spouse choice in this dynamic way and should provide more insights into this hypothesis.

Likewise, this dissertation does not systematically examine the ways that parents and offspring negotiate their preferences in marriage decisions. The discordance between mate preferences in the focus group discussions (Chapter 4) and the preferences displayed by the budget allocation indicate that individuals know what their parents/offspring want in a spouse. Parents and offspring may also try to alter the other party's perception of their choice of spouse directly or through a third party (e.g., a matchmaker). Previous research with the

Tsimane has indicated that physical attractiveness is positively associated with a person's other social and economic qualities (Rucas et al., 2006). If similar relationships are present in Nepal, parents' promotion of other qualities of a potential match's personality, social qualities, or family status could change offspring's perception of physical attractiveness, solving one of the larger sources of disagreement between parents and offspring. Several questions still remain: Are parents and/or offspring likely to modify their ideal standards to find an in-law/spouse that is acceptable to the other party? Are one party's preferences more easily obtainable than the other, independent of marriage type? How much do parents and offspring discuss spouse choice decisions before and during the marriage process? These are questions that could fundamentally change predictions about the relationship between arranged marriage and fitness outcomes. Examining the traits that actual husbands and wives have in relation to ideal parental and ideal offspring preferences may shed light on whether arranged couples reflect parental preferences, offspring preferences, or a mix of both. As a long-term research plan, unmarried respondents who rated their ideal preferences in Chapter 5 could be re-interviewed after marriage to assess their degree of influence in their spouse choice and the qualities their actual spouse has. If spouses are a mix of parental and offspring preferences, even in marriages where offspring report having little input, this may help explain why fitness outcomes do not differ by marriage type.

This dissertation also does not measure other correlates of fitness in arranged marriage contexts. Dowries and inheritances that provide substantial financial incentives for arranged marriages may also improve fitness outcomes. The CVFS does not include individual-level data on dowries or inheritances for the sample assessed here. It also does not measure variables like coital frequency, which could mediate the effect of marriage type on

fertility outcomes, which would be extremely difficult and inappropriate to assess in Nepal. While the CVFS does have data on love and happiness in marriage, respondents are only asked about their current state, and not about how they felt at the time of marriage or when they first felt they loved their current spouse. Data on when they first felt they loved their spouse, or longitudinal data on marital satisfaction throughout the duration of the marriage could plausibly make a difference to fitness outcomes, for example, by mediating the frequency of sexual intercourse. There data are not currently available, so these questions are beyond the scope of this dissertation.

This dissertation also does not consider alternative strategies of exhibiting mate choice in arranged marriage contexts. Extra-marital affairs may be a common way in which individuals are able to obtain the genetic benefits of mate choice while maintaining socioeconomic ties through marriage. However, these data are sensitive and hard to collect in many contexts, especially Nepal (but there are a few notable exceptions, such as the Himba). Divorce and remarriage are not common in Nepal, especially for women who were the focus of Chapter 3, but this is likely a common strategy to achieve individual mate choice in other contexts, especially if remarriages are more likely to be self-chosen. Many ethnographic sources (see Chapter 2) support the use of these two strategies for obtaining individual mate choice in arranged marriage contexts. Thus, studies attempting to test the fitness effects of marriage type need to consider alternative routes to reproduction relevant to the ethnographic context of the population they are studying.

This dissertation also primarily focuses on Nepal, which has a relatively low total fertility rate that is near replacement in rural areas (such as Dhading). This may have implications for testing the hypotheses in this dissertation. First, number of children is likely

closely tied to other factors like socioeconomic status. Families with high socioeconomic status may have fewer children that receive larger inheritances, more investment in education, and higher family support than those who come from larger families (e.g., Goodman, Koupil, & Lawson, 2012). Thus, future studies may consider measuring other outcomes, like educational attainment, socioeconomic status, and familial support as a function of marriage type, as this may show greater differences than fertility outcomes in low, controlled fertility populations.

Low fertility contexts may also show different patterns of parent-offspring conflict than high-fertility contexts. If parents only have one child, for example, then the fitness interests of the parents and child may be in greater alignment than when parents have many children because the parents can only gain grandchildren through that one offspring. Thus, in low fertility contexts family size may also be a relevant variable to consider when looking for fitness differences.

6.C. Future Directions

Cross-culturally (Agey, Morris, Chandy, & Gaulin, 2021) and within my geographic focus of Nepal, there is widespread parent-offspring divergence over ideal preferences in an in-law/spouse; but there is not yet a very clear picture of how parents and offspring negotiate these disparate preferences in actual spouse choice situations. Parents and offspring in Nepal expressed a desire to make each other happy with the choice of spouse and to seek input from each other during the process of spouse selection (see Chapter 4). If offspring are often able to fulfill their requirements for traits like physical attractiveness in arranged marriages via negotiation with their parents or veto power over certain of their parents' selections, then

differences in preferences may be negotiated in a way that satisfies both parties. There is therefore an incentive for parents and offspring to attempt to cooperate. Offspring may advocate for a hybrid model of spouse selection in which parents present pre-approved spouse options to their offspring (i.e., they define the mate pool) and offspring make the final selection; or in which offspring present options to their parents for their approval before marriage. This type of spouse choice is rapidly becoming the norm in Nepal. In cases where parents and offspring are both able to exercise mate choice and find partners that both find acceptable, then both may be able to maximize their fitness interests simultaneously, and this may lead to better outcomes overall than either party making a unilateral spouse choice decision. Offspring fitness may be reduced only in extreme cases where offspring had zero input into spouse choice, which may not be the norm even in most arranged marriages. The sexual selection and mate preference literature should therefore be reexamined to account for the additional fitness benefits that could be gained through collaborative parent-offspring mate choice as compared to fully independent mate choice.

If parents and offspring have the best fitness outcomes when they work together in spouse choice, the question to be examined then becomes: What are the fitness consequences of the shift to more independent mate choice, as is the norm in many WEIRD contexts? Modern technologies that push for highly personalized matches and private expression of preferences, such as dating apps, may largely take over a role of searching for and filtering potential partners that parents and extended kin networks would have previously occupied, but likely without the same filtering criteria that parents would rely on. Thus, the quality of potential mates found through these means may be harder to ascertain because there are more options and no third-party verification of the qualities they claim to have. Therefore, it may

take longer for individuals to find high-quality mates that they find suitable for marriage and/or having children together. Parental involvement in mate selection also raises accountability among the couple. In the focus groups examined in Chapter 4, many participants discussed the role of family in settling marital conflicts and intervening against "bad behavior" in arranged marriages but said this social support network was not available to eloping couples. Similar dynamics may be present in societies dominated by individual mate choice, and this could have consequences for relationship quality, fidelity, or intimate partner violence.

As offspring choice in spouse selection increases in Nepal, other demographic shifts are likely to occur. In this dissertation, offspring showed a consistent lack of concern about caste/ethnicity compared to their parents. As offspring exert more choice, inter-ethnic and inter-caste marriages may thus become more common. In Chapter 4, respondents often discussed the ostracism and poor treatment that intercaste or interethnic couples face in their families and communities, and these couples were more likely to live in nuclear family households in different towns. Intermarriage is thus likely to change social network structures in communities. While there may be lower representation of family and natal community members in their social networks, they may develop broad social ties across previously proscribed social categories. These alternative networks could offer different benefits, like better jobs or opportunities for migration. For example, intermarried couples in Moseten communities in Bolivia were better able to make an economic recovery after crop failures, partially as a result of larger social networks from other communities (Alami, 2022). Assessing the changes in social networks may provide insight into the ways that intermarried

eloping couples in Nepal may compensate for the socioeconomic sanctions they face as a result of their spouse choice method.

The results presented in this dissertation also have implications for international organizations working to end arranged marriages in various contexts. First, findings in this dissertation demonstrate that the term “arranged marriage” is a multi-faceted category that can include varying levels of offspring choice. Organizations, such as Unchained at Last ("Arranged/Forced Marriage," 2023), should thus more clearly differentiate between the terms “arranged marriage” and “forced marriage”, as these are not synonyms, and the conflation of these concepts can be harmful and stigmatizing for certain groups who traditionally practice arranged marriages. Second, organizations aiming to reduce arranged marriage should take a more nuanced and sensitive approach. The relationship between arranged marriages and other benefits, like social and financial support, indicates that these marriages may offer significant benefits, and banning them may prevent people from accessing those important resources. There also do not seem to be any differences in offspring survival (Chapter 3, Sorokowski, Groyecka, et al., 2017) or birth weight (Hasnain, 2020) between arranged and non-arranged marriages. Instead of a focus on eliminating arranged marriages, a focus may be placed on encouraging dialogue between parents and offspring in these marriage decisions. This is especially sensible if parental and offspring preferences offer complimentary benefits. Promoting cooperation in mate choice may lead to better outcomes for individuals and less stigmatization for populations with a tradition of arranged marriage.

Further research on the relationship between mate choice and fitness outcomes can also support important policy decisions surrounding the fertility industry. In the US, there have been several notable cases of fertility doctors using gametes from a donor that the

conceiving individual or couple did not consent to using ("Donor Deceived," 2023; Mroz, 2019). In these cases, there is no opportunity to express individual mate preferences, nor is there any kin input into the qualities of the donor. These, therefore, represent extreme cases where neither individuals nor their families are able to express any amount of mate choice, and, based on theory, may therefore experience poorer reproductive or child health outcomes. Researching the outcomes of these cases may help promote policies that better regulate the fertility industry, as only 10 US states have passed laws preventing fertility doctors from switching the donor without consent, and a federal bill is currently under consideration (Right To Know, 2023).

6.D. Conclusion

Thanks to the scientific method, the history of human knowledge is a non-random walk. Every researcher should strive to improve the roadmap guiding that walk. The contribution of my dissertation is to clarify the links between sexual selection's shaping of mate-choice criteria (Darwin, 1871)and the social embeddedness of human reproduction (Hrdy, 2009). The road it points down is the study of how parents and offspring compromise on the genes that will be brought into the lineage, and the ways that parents may differentially support the reproduction of offspring who are more responsive to parental wishes.

6.E. References

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Chapter 7: Appendices

7.A. Supporting material for Chapter 3

Table 7.1: Descriptive statistics for dichotomous spouse choice categories for women in the CVFS sample

	Non-arranged (n=778)		Arranged (n=717)	
Statistic	Mean	St. Dev.	Mean	St. Dev.
Age***	38.0	10.6	45.3	10.4
Age at Marriage***	21.9	4.0	20.7	4.7
Marriage Year***	1993	10.9	1984	12.4
Age at First Birth	24.1	4.2	24.2	5.0
Total Children***	2.8	2.0	3.9	2.3
Total Surviving Children***	2.6	1.7	3.5	1.9
Total Years on Birth Control**	3.3	4.2	2.7	4.2
Years Attended School	6.1	4.4	5.8	4.5
Household Income Level	3.2	1.3	3.3	1.4

*** indicates means are significantly different at $p<.001$

** indicates means are significantly different at $p<.05$

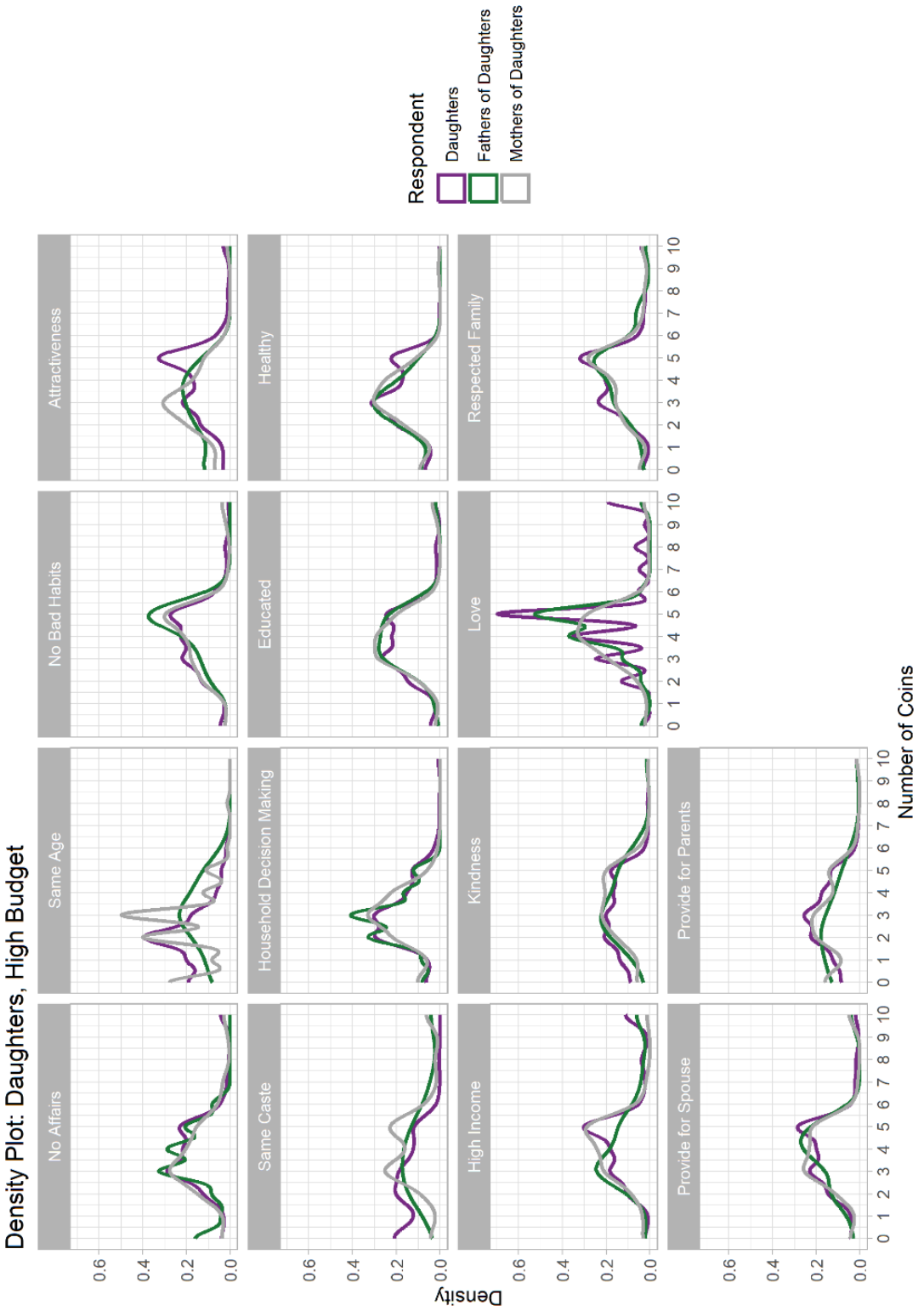
Table 7.2: Mean coin allocations per trait for high and low budgets for mothers and fathers, separately.

	High Budget				Low Budget			
	For Daughters		For Sons		For Daughters		For Sons	
Trait	M	F	M	F	M	F	M	F
No Affairs	3.79	3.24	3.75	4.45	0.91	1.07	1.01	1.45
Same Age	2.38	2.86	2.26	2.13	0.37	0.31	0.28	0.53
No Bad Habits	4.21	4.1	4.25	3.94	1.13	1.24	1.25	0.96
Attractiveness	3.04	2.69	3.25	3.4	0.75	0.59	0.77	0.96
Same Caste	4.32	4.24	3.63	4.38	1.81	1.9	1.33	2.09
Household Decisions	2.7	2.72	3.03	2.91	0.54	0.41	0.41	0.79
Educated	3.98	4	3.42	3.74	0.63	1.28	0.74	1.04
Healthy	2.96	2.76	3.58	3.25	1.49	1.34	1.56	1.13
High Income	3.97	4.55	3.35	3.42	0.61	0.34	0.5	0.38
Kindness	3.44	3.59	3.76	3.62	0.61	0.86	0.56	0.58
Love	4.19	4.41	3.92	3.74	0.95	1.45	0.96	1.06
Respected Family	4.32	4.31	4.61	4.55	3.91	2.52	4.23	2.55
Provide for Spouse	3.96	4	3.61	3.34	0.81	1.31	0.73	0.79
Provide for Parents	2.74	2.52	3.61	3.15	0.47	0.38	0.68	0.68

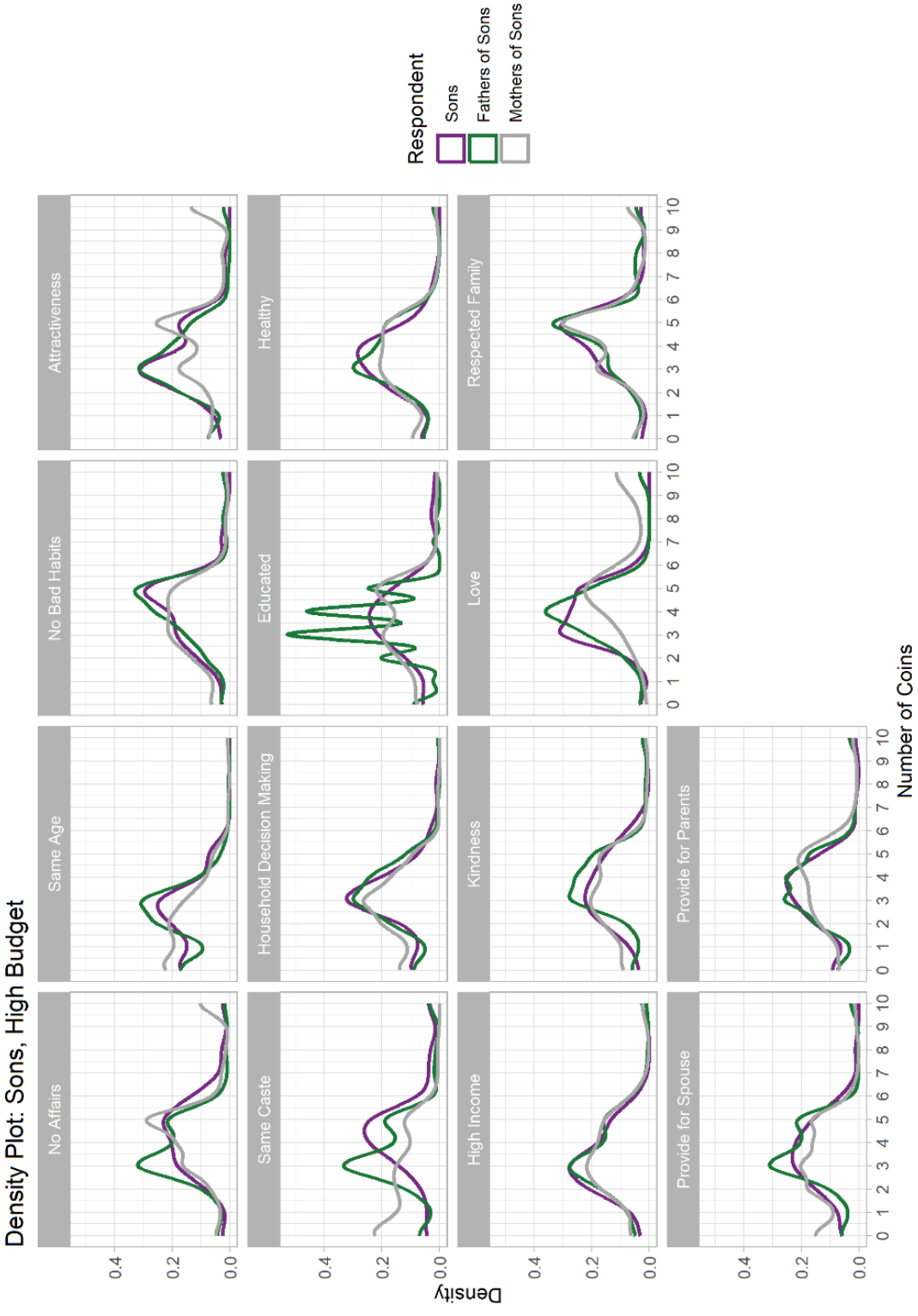
M=Mothers, F=Fathers

Figure 7.1: Density plots for each trait by group and budget (A-D).

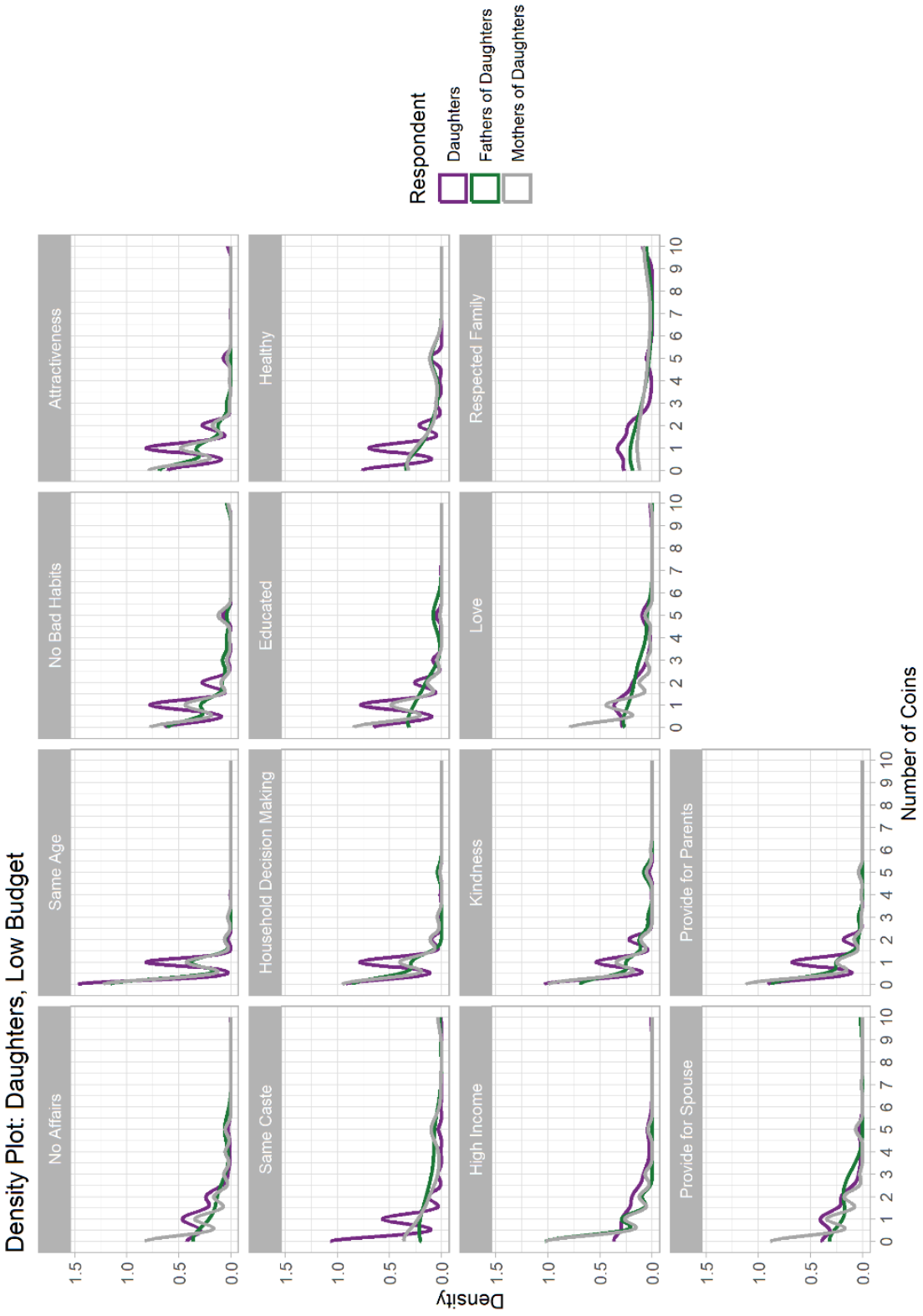
A.



B.


Density Plot: Sons, High Budget
No Affairs
Same Age
No Bad Habits
Attractiveness
Same Caste
Household Decision Making
Educated
Healthy
High Income
Kindness
Love
Respected Family
Provide for Spouse
Provide for Parents
Density
0.0
0.2
0.4
0 1 2 3 4 5 6 7 8 9 10
Number of Coins
Respondent
Sons
Fathers of Sons
Mothers of Sons

C.


Density Plot: Daughters, Low Budget
No Affairs
Same Age
No Bad Habits
Attractiveness
Same Caste
Household Decision Making
Educated
Healthy
High Income
Kindness
Love
Respected Family
Provide for Spouse
Provide for Parents
Density
Number of Coins
Respondent
Daughters
Fathers of Daughters
Mothers of Daughters

D.

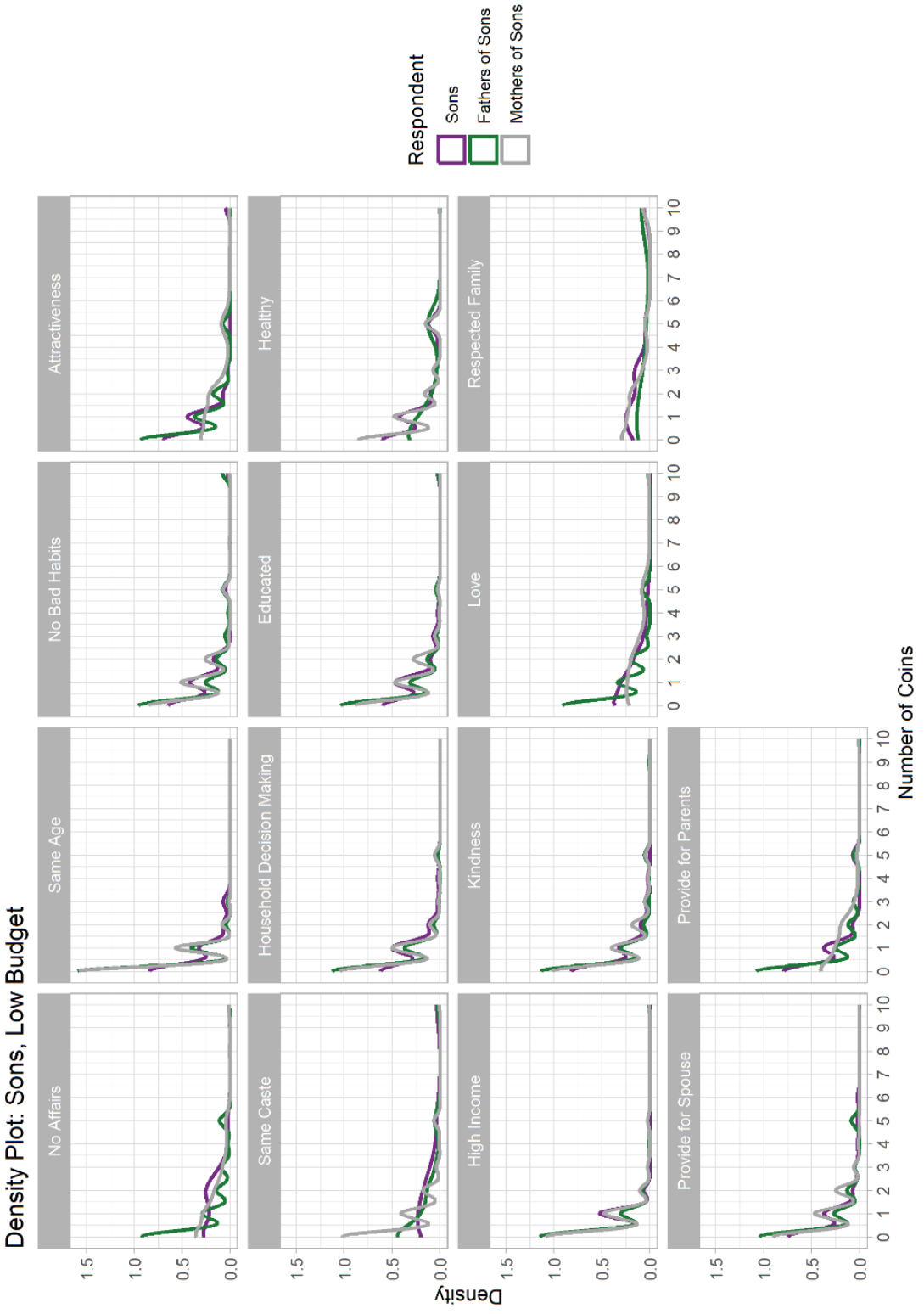

Density Plot: Sons, Low Budget
No Affairs
Same Age
No Bad Habits
Attractiveness
Same Caste
Household Decision Making
Educated
Healthy
High Income
Kindness
Love
Respected Family
Provide for Spouse
Provide for Parents
Density
Number of Coins
Respondent
Sons
Fathers of Sons
Mothers of Sons

Table 7.3: Cohen's d values for each comparison for each budget

	Trait	P-D	M-D	F-D	P-S	M-S	F-S	W-M
High Budget	No Affairs	-0.117	-0.059	-0.341	-0.348	-0.422	-0.118	-0.37
	Same Age	0.394	0.329	0.68	0.171	0.188	0.113	-0.01
	No Bad Habits	0.168	0.177	0.125	0.326	0.364	0.205	0.18
	Attractiveness	-0.577	-0.534	-0.709	-0.56	-0.551	-0.465	-0.26
	Same Caste	1.029	1.062	1.069	0.805	0.72	1.087	0.05
	Household Decisions	-0.183	-0.184	-0.165	0.287	0.31	0.229	0.28
	Educated	0.109	0.105	0.117	0.055	0.008	0.167	0.21
	Healthy	-0.117	-0.148	-0.286	0.094	0.138	-0.035	-0.07
	High Income	-0.336	-0.392	-0.125	-0.05	-0.058	-0.025	0.60
	Kindness	0.218	0.201	0.274	0.281	0.299	0.227	-0.06
	Love	-0.372	-0.388	-0.272	-0.87	-0.807	-0.843	-0.32
	Respected Family	0.007	0.008	0.004	-0.033	-0.025	-0.051	-0.17
	Provide for Spouse	0.073	0.069	0.09	0.299	0.33	0.197	0.46
	Provide for Parents	-0.14	-0.118	-0.235	-0.061	-0.001	-0.22	-0.33
Low Budget	No Affairs	-0.083	-0.113	0.018	-0.16	-0.227	0.018	-0.25
	Same Age	-0.081	-0.059	-0.167	0.007	-0.109	0.287	0.11
	No Bad Habits	-0.04	-0.054	0.011	0.136	0.176	0.029	0.19
	Attractiveness	-0.333	-0.302	-0.393	-0.494	-0.536	-0.366	-0.27
	Same Caste	0.691	0.702	0.966	0.406	0.324	0.784	-0.09
	Household Decisions	-0.157	-0.128	-0.271	-0.111	-0.22	0.159	0.02
	Educated	-0.248	-0.384	0.184	0.028	-0.034	0.216	0.24
	Healthy	0.281	0.307	0.226	0.204	0.267	0.027	-0.04
	High Income	-0.535	-0.485	-0.618	-0.088	-0.054	-0.184	0.55
	Kindness	-0.002	-0.054	0.196	-0.134	-0.135	-0.128	-0.06
	Love	-0.315	-0.368	-0.098	-0.535	-0.527	-0.477	-0.17
	Respected Family	0.465	0.558	0.137	0.479	0.606	0.143	-0.01
	Provide for Spouse	-0.159	-0.245	0.128	-0.036	-0.051	0.004	0.28
	Provide for Parents	-0.289	-0.266	-0.347	-0.329	-0.323	-0.307	-0.28

M=Mothers, F=Fathers, P=All Parents, D=Daughters, S=Sons, W-M=Women and Men. For all parent-offspring values, negative numbers indicate the trait is preferred more by offspring and positive numbers indicate the trait is preferred more by parents. In the men and women comparison, positive numbers indicate a trait is preferred more by women and negative numbers indicate the trait is preferred more by men.

Table 7.4: List of traits added by participants

Unmarried Respondents	Parent Respondents
Mutual Understanding	Understanding
Respect for me	Good behavior
Respect for my family	Respectful
Honesty	Able to do work
Only focus on me	
Most experienced	
Silent	
Does all work, even if it's private	
"Laughing face"	
Easygoing	
Trustworthy	
Has to give his money	
Supportive	
"Clear types"	
Has a job	
Makes me a 50% shareholder	
Has a responsibility toward me and his family	

Traits named in response to the question "Are there any traits that were not listed on these cards that you would like to have in a spouse/in-law?", asked to each participant after doing both budget allocation tasks.