

Evolving Motivations? Cross-Cultural Data Show Links Between Fundamental Social Motives and Fertility

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Fundamental social motives represent an evolutionary-informed taxonomy of human motivational forces; however, it is still unknown if these motives are currently related to fitness. We used publicly available cross-cultural data to provide an answer to this question. Generalized linear mixed models with random slopes were built to estimate the relations between motives and reproductive success (i.e., number of children) as a measure of evolutionary fitness; socioeconomic status was analyzed as a predictor as well (sample size varied from $N_{\min} = 2,036$ to $N_{\max} = 13,555$ for different analyses due to data structure). The results showed positive associations between reproductive success, care for family members and biological children in particular, and negative associations between reproductive success and mate-finding to a lesser degree. Self-protection and a motive to retain long-term romantic partner were significant positive predictors of reproductive success only in participants with the lowest socioeconomic status, thus suggesting that they may elevate fitness in harsh environmental conditions. Care for biological children was positively associated with fertility, especially in female participants. Obtained results suggest that fundamental social motives may still evolve in contemporary humans, with an emphasis on kin care, long-term mating, and self-protection in dangerous environments. The data provide new incentives for a behavioral ecological analysis of the motivational forces in humans.

Public Significance Statement

Motives are crucial for understanding behavior; however, currently, it is largely unknown if motivations still evolve in contemporary human populations. Present results, based on a large intercultural sample, show associations between fundamental social motives and reproductive success (i.e., number of children) which suggest that motives may be under natural selection and hence, still evolving in humans. The findings suggest that selection may favor care for biological relatives and especially biological children, together with long-term mating and self-protection, especially in harsh ecological conditions.

Keywords: fundamental social motives, reproductive success, kin care, mating, self-protection

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Fundamental Social Motives (FSMs)

Human behavioral ecologists frequently measure the associations between behavioral traits and evolutionary fitness: by examining these associations we can analyze if traits are under

natural selection, as well as the mechanisms of their evolution. Furthermore, behavioral traits are governed by motives, both in humans and other animals; this is why psychologists often posit that the study of motivation is crucial for understanding and predicting behavior. Therefore,

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motivation represents one of the major research topics in psychology and scholars invest a significant effort to describe and measure motivation (Ryan, 2012). There are many taxonomies of motives, but they were rarely devised in an explicit evolutionary framework, that is, by analyzing in which way motives generate behavior that increases survival and reproduction. This has recently changed and the prominent taxonomy of motives based on evolutionary theory was conceptualized—the framework is labeled as FSMs (Cook et al., 2021; Kenrick et al., 2010; Schaller et al., 2017). The taxonomy distinguishes several motives related to fitness-relevant behavior (Neel et al., 2016): Self-protection (including protection from dangerous conspecifics and protection from pathogens), affiliation (expressed as the importance of belonging to a group, concerns about being excluded from the group, or insisting on independence), status-seeking, mate-seeking, mate retention (the tendency to preserve a long-term romantic relationship including the fear of being left by a partner), and kin care (which covers care for children and care for other biological relatives). FSMs are related to various behavioral patterns (Cook et al., 2021) including social interaction: for example, people are mostly interested to learn about kin care and mate retention motives when meeting others (Billet et al., 2023). Congruently with this, these same motives are also the ones that individuals value as the most important in self-evaluation (Ko et al., 2020). Hence, when evaluating ourselves and others, the motives are not equally important—there is a certain hierarchy that emphasizes care for biological relatives and romantic partners.

Goals of the Present Research: Are FSMs Associated With Reproductive Fitness?

FSMs generate behaviors that are closely linked to evolutionary fitness (survival and reproduction); therefore, it can be plausibly assumed that they evolved via natural selection. However, we do not know anything about the ongoing evolution of FSMs so far: are FSMs related to fitness in contemporary human populations? To answer this question, human evolutionary ecologists typically examine the associations between the traits and reproductive success (i.e., number of offspring), similarly to other species, because reproductive

success is the core component of fitness. There are data showing that at least some of the FSMs show heritable genetic variation, for example, disgust sensitivity (which is a construct similar to disease avoidance: Sherlock et al., 2016), sociosexuality (i.e., short-term mating: Bailey et al., 2000) and parental care (Pérusse et al., 1994). Hence, if there is selection on FSMs, they can respond to selection and evolve in contemporary human populations.

Indeed, previous research showed that FSMs may be related to reproductive success. For example, care for biological relatives, self-protection, and affiliation to a group are positively associated with parenthood status (Neel et al., 2016). Congruently with this finding, another study found that these same motives are related to increased positive reproductive motivation—a sum of reasons that facilitate decisions to start a family and have children (Međedović, 2022). Therefore, we can plausibly assume that these motives may be positively related to fitness. Interestingly, contrasted hypotheses can be set for parental care. Quantity–quality tradeoff posits that the amount of care the parents can produce diminishes with every new offspring due to limited resources (Lawson & Mace, 2011). Hence, parental care should be negatively associated with the number of children, a result that some previous studies have indeed obtained (Međedović & Petrović, 2019). However, the inverse association between parental care and reproductive success may be crucially dependent on fertility rates in the population—the higher the overall fertility is, the more likely the tradeoff will emerge. During demographic transition, human populations shifted to the reproductive ecology marked by low fertility and high investment in offspring, probably in order to help their offspring to compete in market economies (Lawson & Borgerhoff Mulder, 2016). Decreased variation in both fertility and investment diminished negative correlation between them that is predicted by the tradeoff. In fact, parental care may be positively associated with parenthood motivation and thus positively related to reproductive success. For example, it has been found that care for children is negatively correlated with the age of first reproduction—individuals who had their first child earlier in their lifetime showed elevated parental care (Međedović, 2021a). Having in mind that earlier age of first birth is a reliable and robust predictor of higher reproductive success (Milot et al., 2011;

Pelletier et al., 2017; Troup et al., 2015), the same association may stand for parental care as well.

Evolutionary psychologists often assume that short-term mating tends to be related to higher reproductive success as well: short-term mating is thought to be a part of the “fast” life history pathway characterized by earlier reproduction and a higher number of offspring (Lawson, 2011). However, the existing data do not support this assumption: short-term mating (measured as the number of sexual partners) tends to be unrelated or even negatively associated to fertility (Gutiérrez et al., 2022; Međedović, 2021b). Conversely, the same studies showed that long-term mating (operationalized as the duration of the longest partner relationship) is positively related to reproductive success and earlier age of first reproduction. These associations may be extended to the underlying motivation for these behaviors—mate-seeking and mate retention, respectively.

The links between socioeconomic status and fertility have been empirically examined in the previous research as well. The results are ambiguous (Stulp & Barrett, 2016); this may be the consequence of the fact that the association between status and fertility differs between sexes—it is negative for women, but nonexistent or even positive for men (Goodman & Koupil, 2009; Hopcroft, 2019, 2021). Furthermore, status seems to be a complex construct and its different aspects may have opposite associations with reproductive success. For example, education levels and associated prestige occupations are negatively related to fertility while the opposite stands for material wealth (Hackman & Hruschka, 2020).

Finally, when examining the associations between FSMs and fertility, we should analyze certain moderating variables as well. First, environmental characteristics should be taken into account. One of the main ecological characteristics analyzed in evolutionary sciences is environmental harshness—it can be broadly defined as the levels of resource scarcity, stress, hostile interactions, or deprivation, that is, all factors that elevate mortality rates in the population (Ellis et al., 2009). The associations between behavioral traits and fitness are often moderated by environmental harshness—the traits can be adaptive in certain environments but neutral or even maladaptive in others. We can take self-protection motives as an example—they may

not be beneficial for fitness in supporting environments and those abundant with resources, but they can positively contribute to fitness in harsh and potentially dangerous ecologies. Second, sex should be also analyzed because fitness benefits of FSMs may differ for males and females. A clear example is the status-seeking motive: previous research showed that the association is not different from zero, or is even positive for males but usually negative for females (Goodman & Koupil, 2009; Hopcroft, 2019, 2021) because women pay a higher price for their career success when they decide to have children. Hence, if we do not analyze the potential moderating role of sex in the status-fertility link we risk omitting the opposite associations in men and women.

To summarize, the main goal of the current research is to produce estimates of the relations between FSMs and reproductive success (i.e., number of children) as an indicator of evolutionary fitness and analyze the potential moderating role of sex and environmental conditions in the links between motives and reproductive success. According to the existing research, kin care motives may be related to elevated fertility; long-term mating (mate retention and fear of breakup) should be positively related to the number of children while the opposite may be assumed for the short-term mating. The relation between status-seeking and fertility may be different for males and females; positive associations can be expected for the former and negative for latter.

Method

Sample and Data

We used a publicly available data set to empirically evaluate the associations between FSMs and fertility; the data are described in detail in Pick et al. (2022), and it can be found on the following link: <https://osf.io/p9z2a/>. The data were collected via an international project of cross-cultural examination of FSMs in 42 countries from all inhabited continents. The samples from all countries were based on convenience sampling and included community samples, university populations, and the participants who were recruited via crowdsourcing platforms like Prolific or Amazon’s Mechanical Turk. We used the “Master” data set that contains all participants: it is consisted of 18,722 responders; however, the authors of the data set suggested

that certain participants should be removed from the analysis due to invalid responses or systematically missing data on FSM scales. When all participants with missing relevant scores were excluded, the final sample consisted of 13,555 participants ($M_{\text{age}} = 26.18$ [$SD = 9.71$]; 63.7% females; 42 countries). The number of participants highly varied across the countries: the most of participants came from Senegal (8.6%), the United States (5.9%), and the United Kingdom (5.8%), while Serbia, Nigeria, and Saudi Arabia had the lowest sample sizes (0.4% for all countries). The exact sample sizes for all countries, percentages of male and female participants, means and standard deviations for participants' age, and socioeconomic status (SES) are provided in the online supplemental materials.

Measures

FSMs were assessed via the FSM Inventory (Neel et al., 2016). It has 66 items and 11 subscales (six items per every scale): self-protection ($M = 4.67$; $SD = 1.23$; $\alpha = .82$), disease avoidance ($M = 4.26$; $SD = 1.26$; $\alpha = .77$), affiliation group ($M = 5.01$; $SD = 1.03$; $\alpha = .76$), affiliation exclusion concern ($M = 4.47$; $SD = 1.28$; $\alpha = .82$), affiliation independence ($M = 4.36$; $SD = 1.27$; $\alpha = .81$), status ($M = 4.58$; $SD = 1.16$; $\alpha = .76$), mate seeking ($M = 3.33$; $SD = 1.49$; $\alpha = .82$), mate retention ($M = 5.71$; $SD = 1.06$; $\alpha = .67$), mate retention—breakup concern ($M = 3.44$; $SD = 1.62$; $\alpha = .86$), kin care family ($M = 5.68$; $SD = 1.18$; $\alpha = .85$), and kin care children ($M = 5.55$; $SD = 1.44$; $\alpha = .73$). Likert-type scale was used for responding with seven points (1 = *strongly disagree* to 7 = *strongly agree*). Note that the mate retention scales were administered only to the participants who were in a relationship during data collection while the data on the kin care Children scale were collected only from parents.

Subjective socioeconomic status ($M = 6.14$; $SD = 1.72$) was measured via the following item: "Think of the ladder below as representing where people stand in your country. At the top of the ladder (10) are the people who are the best off—those who have the most money, the highest education and the most respected jobs. At the bottom (1) are the people who are the worst off—those who have the least money, the lowest education level and the least respected jobs. Where would you put yourself on the ladder?"

Due to the exact phrasing of this item, we believe that the lowest scores on the measure can be interpreted as harsh environmental conditions while the high scores can be viewed as the beneficial environment.

Finally, the participants' sex, age, country, and number of children ($M = 0.28$; $SD = 0.73$) are analyzed as well (for the number of children, the scores were: 0, 1, 2, 3, and 4 and more).

The Plan of Data Analysis

Bivariate associations between the examined variables were shown first: Spearman's correlation coefficients were calculated because the number of children is a rank variable. The main analyses were based on generalized mixed models: sex, age, subjective SES, and FSMs were analyzed as the predictors while the number of children was set as the criterion variable with Poisson's distribution; the participants' country was set as the nesting variable. Due to the nature of the measures, three models were estimated: (a) in the first model, all FSMs are included except the mate retention motives and the kin care children motive—this model was fitted for the whole sample; (b) mate retention motives were included in the second model and it was fitted only for a subsample of participants that were currently in a relationship; (c) kin care children was included in the final model, which was estimated only for the subsample of parents. All models were first estimated using only random intercepts; however, due to the fact that random slope models showed better fit to the data, final models included the estimations of random slopes as well. Finally, two-way interactions between FSMs, subjective SES, and participants' sex were analyzed as well. Mixed models were estimated using the lme4 package in R (Bates et al., 2015); we used the lmerTest package (Kuznetsova et al., 2017) to obtain the p values for fixed effects, and the sjstats package (Lüdtke, 2021) to estimate the coefficients of determination.

Results

Correlations Between the Examined Variables

Correlation analysis showed that affiliation exclusion concern, mate-seeking, mate retention

breakup concern, and status were negatively correlated with the number of children; positive correlations with fertility were detected for kin care family, kin care children, disease avoidance, affiliation group, and affiliation independence. Note that several correlation coefficients were very low in magnitude and their significance is the consequence of the large sample size. The results of correlation analysis are shown in Table 1.

Mixed Models for the Prediction of Reproductive Success

We estimated three generalized mixed models with random slopes for the prediction of reproductive success. First, we compared random intercepts and random slopes models for the first regression function. For random intercepts model, the following estimations were obtained: Akaike information criterion = 12,871.80; Bayesian information criterion = 12,969.50. For random slopes model, the estimations were: Akaike information criterion = 12,523.30; Bayesian information criterion = 12,861.40. Hence, the random slopes model showed higher fit to the empirical data; the difference between models' fit was statistically significant as well: $\chi^2(32) = 412.48$; $p < .001$. This result suggested that the model should be fitted with the inclusion of random slopes; we estimated all three models in the same manner to obtain the equivalent conditions for all predictions. Table 2 contains model characteristics, fixed and random effects, and significant interactions. If we examine fixed effects for the first model, we can see that participants' age and kin care family have a positive contribution, while mate-seeking has a negative contribution to the prediction of fertility. Mate retention motives were added in the second model, but neither of these motives had an independent contribution to the prediction; only kin care family remained as a significant predictor. Finally, the kin care children motive was added in the third model and it showed a significant positive fixed coefficient. The percentages of the criterion's explained variation were high in every prediction. We can also see that there is variation in the slopes across the countries and that there is difference in these effects for different FSMs: affiliation (exclusion concern) has the highest variation in the first model, mate retention in the second, and kin care (children) in the final model.

Table 1
Correlations Between the Examined Variables

Analyzed variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Self-protection	—											
2. Disease avoidance	.46**	—										
3. Affiliation (group)	.15**	.05**	—									
4. Affiliation (independence)	.03**	-.04**	-.36**	—								
5. Affiliation (exclusion concern)	.22**	.08**	.24**	-.09**	—							
6. Status	.33**	.24**	.30**	-.14**	.30**	—						
7. Mate-seeking	-.02*	-.03**	.04**	-.09**	.22**	.13**	—					
8. Breakup concern	.25**	.12**	.05**	-.05**	.40**	.23**	.29**	—				
9. Mate retention	.11**	.10**	.14**	-.15**	.08**	.05**	-.31**	.06**	—			
10. Kin care (family)	.20**	.15**	.38**	-.25**	.03**	.16**	-.12**	-.04**	-.27**	—		
11. Kin care (children)	.27**	.18**	.22**	-.02	-.01	.08**	-.32**	-.11**	.41**	.42**	—	
12. SES	-.09**	-.10**	.10**	-.02	-.03**	.03**	-.02**	-.10**	.05**	.04**	.01	—
13. Number of children	.01	.05**	.02*	.05**	-.14**	-.06**	-.24**	-.14**	-.01	.09**	.30**	.06**

Note. SES = socioeconomic status.
* $p < .05$. ** $p < .01$.

Table 2*Prediction of Reproduction Success by Fundamental Social Motives*

Predictors and model characteristics	<i>B</i> (<i>SE</i>)	<i>SD</i>	<i>B</i> (<i>SE</i>)	<i>SD</i>	<i>B</i> (<i>SE</i>)	<i>SD</i>
Predictors						
SES	0.03 (0.01)	0.05	0.00 (0.01)	0.02	-0.00 (0.01)	0.02
Age	0.10 (0.01)***	0.03	0.09 (0.01)***	0.04	0.03 (0.00)***	0.01
Gender	-0.04 (0.06)	0.20	-0.04 (0.06)	0.02	-0.01 (0.04)	0.04
Self-protection	0.02 (0.02)	0.06	0.00 (0.02)	0.02	-0.02 (0.02)	0.01
Disease avoidance	-0.04 (0.03)	0.13	0.02 (0.03)	0.08	0.00 (0.02)	0.01
Affiliation (group)	-0.01 (0.03)	0.09	-0.02 (0.02)	0.05	-0.04 (0.02)	0.01
Affiliation (independence)	-0.05 (0.02)	0.07	-0.02 (0.02)	0.04	-0.03 (0.02)	0.02
Affiliation (exclusion concern)	-0.04 (0.03)	0.17	-0.03 (0.03)	0.10	0.01 (0.02)	0.05
Status	0.02 (0.03)	0.08	-0.01 (0.03)	0.08	0.01 (0.02)	0.02
Mate-seeking	-0.19 (0.02)***	0.12	-0.06 (0.03)	0.09	-0.04 (0.03)	0.08
Kin care (family)	0.11 (0.03)***	0.14	0.13 (0.03)***	0.09	0.05 (0.03)	0.03
Mate retention			-0.07 (0.04)	0.16	0.02 (0.04)	0.13
Mate retention (breakup concern)			0.02 (0.02)	0.05	0.02 (0.04)	0.02
Kin care (children)					0.27 (0.05)***	0.17
Interactions						
Self-Protection × SES	-0.02 (0.01)*					
Mate Retention (Breakup Concern) × SES			-0.02 (0.01)**			
Kin Care (Children) × Gender					-0.13 (0.04)***	
Model characteristics						
<i>R</i> ²	.63		.68		.52	
Sample size	13,555		7,708		2,710	

Note. Fixed coefficients are marked significant taking into account Bonferroni correction. *B* (*SE*) = fixed coefficients with standard errors (in parentheses); *SD* = random coefficients (standard deviations of the slopes across the countries); SES = socioeconomic status.

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

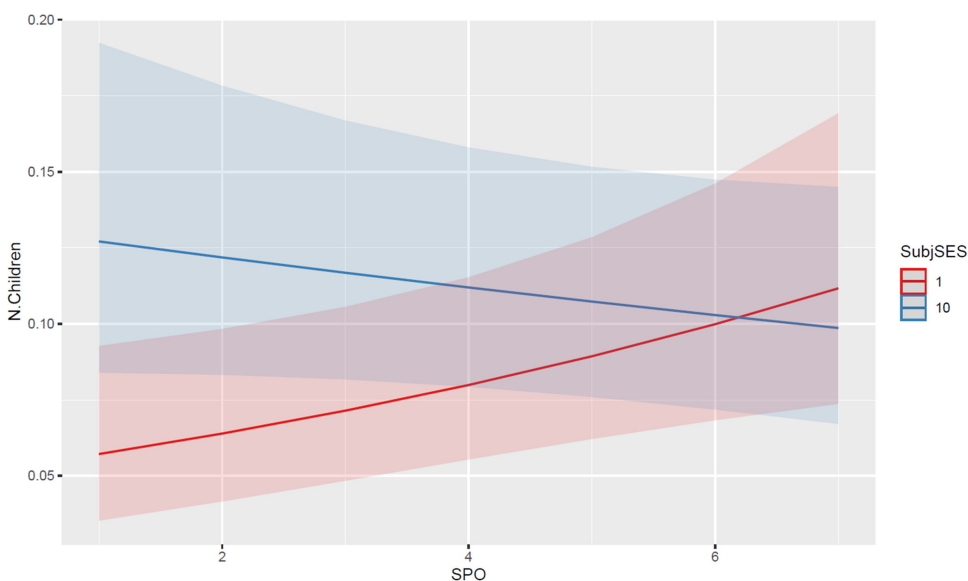
Three significant interactions were obtained, one per every model. The first interaction (Figure 1) showed opposite relations between self-protection and fertility depending on the participants' SES: self-protection positively predicts reproductive success in the conditions of socioeconomic scarcity; the opposite is found in highly beneficial environments. A very similar interaction is obtained for mate retention breakup concern: it positively predicts fertility in low SES conditions while negatively predicting fertility in high SES environments (Figure 2). Finally, while kin care children is positively associated with reproductive success for both sexes, high parental care increases fertility more for females than males; similarly, low parental care decreases fertility more for mothers than fathers (Figure 3).

Discussion

FSMs represent a set of motives that generate behavior related to fitness-relevant outcomes: survival, interaction with in-group members, status, mating, and kin care. These motives can also be seen in other species, thus it can be reasonably

assumed that they evolved via natural selection. Having evolutionary biology as its conceptual framework, FSM taxonomy holds heuristic potential to enrich evolutionary social sciences and provide new insights into behavioral evolution. We believe that one of these insights refers to the current evolution of FSMs; therefore, the key goal of the current manuscript was to explore whether FSMs are related to reproductive fitness in 42 countries. The results of our analyses were largely congruent with the existing data on FSMs: positive relations between care for children and other family members and reproductive success were found, followed by negative associations between finding new mates and fertility. Self-protection and fear of losing a long-term romantic partner positively predicted fertility only in harsh environments, while parental care was especially related to reproductive fitness for females. Therefore, the present data found indices for natural selection on several FSMs and specified additional conditions for selection on certain motives—environmental characteristics and sex. We say “indices” for selection because certain sample limitations prevent us from speaking about natural selection directly—the most

Figure 1
Interaction Between Self-Protection and Socioeconomic Status in the Prediction of Reproductive Success



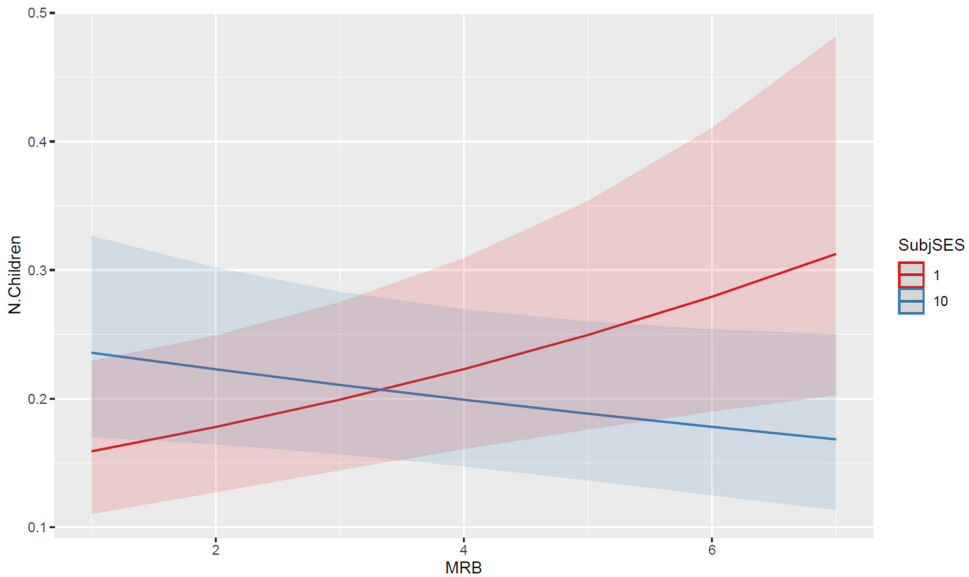
Note. SPO = self-protection; subjSES = socioeconomic status; N.Children = reproductive success. See the online article for the color version of this figure.

important one is the average age of participants in the current sample. Having in mind the mean age of the participants, it is clear that the number of children assessed in the current research does not represent lifetime reproductive success—it could be better viewed as early fertility. However, considering that early fertility is a reliable and robust predictor of completed fertility (Milot et al., 2011; Pelletier et al., 2017; Tropf et al., 2015), we can still use our criterion variable as a valid measure of fitness, while taking this limitation into account. Previous research suggested that FSMs show genetic variation (Bailey et al., 2000; Pérusse et al., 1994; Sherlock et al., 2016), therefore representing evolvable behavioral dispositions—if they are affected by selection, they can respond and further evolve in contemporary human populations. This way our results contribute to the knowledge of current adaptiveness of FSMs (considering reproductive success as a criterion for biological adaptation or fitness), together with specifying sex and environmental differences that moderate the links between motives and fitness; this in turn may represent a foundation for the future behavioral ecology of FSMs.

The Associations Between FSMs and Fitness

Our findings suggested that care for biological relatives is positively associated with reproductive success—this result is in line with previous findings on the relations between kin care and parenthood status (Neel et al., 2016) and reproductive motivation (Međedović, 2022). This association can be explained in two ways. First, kin care can be viewed as a fitness component as well, but in this case, this is inclusive fitness—evolution can support behavior oriented toward helping our biological relatives because we share genes with them (Hamilton, 1964; Maynard Smith, 1964). Hence, this association can be viewed as a congruence between two fitness components. Second, biological relatives often motivate us to have children of our own—fertility values and norms are shared between family members, including help from other family members in raising children (Kolk, 2014; Newson et al., 2007). Therefore, the link between general kin care and reproductive success can be explained by evolutionary-driven cultural mechanisms of fertility transmission between biological relatives. Having in mind

Figure 2
Interaction Between Mate Retention (Breakup Concern) and Socioeconomic Status in the Prediction of Reproductive Success



Note. MRB = mate retention (breakup concern); subjSES = socioeconomic status; N.Children = reproductive success. See the online article for the color version of this figure.

their participation in fitness optimization, it is not surprising that kin care motives are most highly prioritized both when we evaluate our own motives (Ko et al., 2020) and the motives we wish to know in other people (Billet et al., 2023).

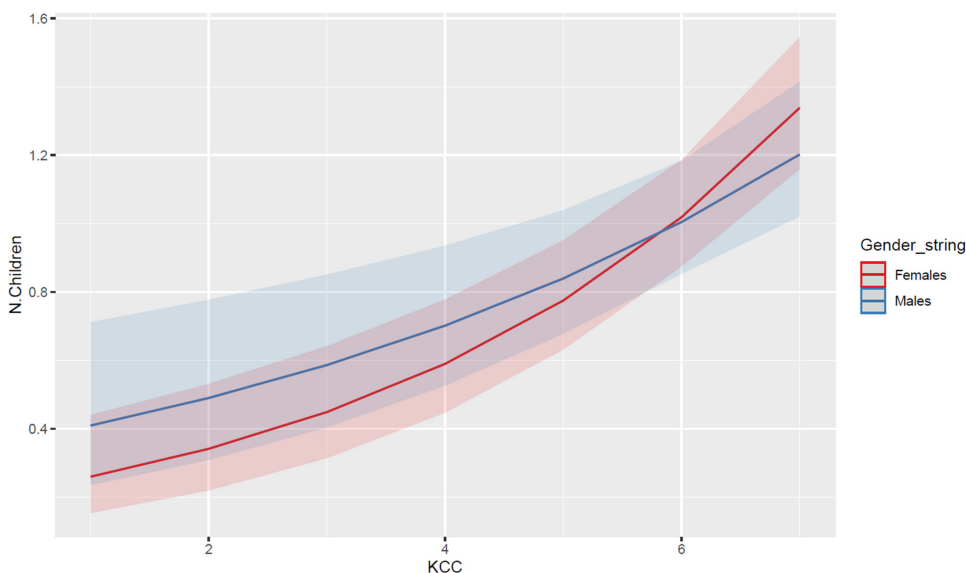
The motive to find new mates was negatively associated with fitness—this is congruent with existing findings showing that short-term mating is unrelated or negatively related to reproductive success (Gutiérrez et al., 2022; Međedović, 2021b). Hence, the motivation for finding new mates may interfere with reproductive behavior. Previous findings have also suggested that having stable and long-standing partner relations is in fact beneficial for fitness (Međedović, 2021b). We did not obtain this finding as clearly, but the present data suggest that an aspect of long-term mating—fear of breakup—can positively predict fitness, especially in low SES environmental conditions. It seems that long-term partner coalitions can increase fitness, particularly in harsh ecologies, perhaps because partner support in reproduction and parental care may be especially important in environments where resources are scarce. Similarly, the motive for self-protection is related to heightened fertility only in

harsh environments. This is not surprising—in safe environments abundant with resources, self-protection may not be related to survival and fertility; its adaptive role may be expressed only in the ecologies where danger may represent a real threat for fitness. We would like to emphasize the previous results obtained in individuals who did not have children that showed links between FSMs and reproductive motivation: mate retention breakup concern and kin care family showed the strongest links with the motives favoring parenthood, (Međedović, 2022). These results are in high congruence with the current data which show the convergent links between motives, reproductive motivation, and observed reproduction; when we have in mind a robust link between reproductive motivation and observed fertility (Liefbroer, 2009; Miller et al., 2010), this convergence is not surprising.

There are some hypothesized effects that we did not detect, for example, the moderation of participants' sex in the link between status-seeking and reproductive success. Previous findings have shown that status may have opposite relations with fertility for males and females: positive links have been found in the former and

Figure 3

Interaction Between Kin Care (Children) and Participants' Sex in the Prediction of Reproductive Success



Note. KCC = kin care (children); gender_string = participants' sex; N.Children = reproductive success. See the online article for the color version of this figure.

negative in the latter (Goodman & Koupil, 2009; Hopcroft, 2019, 2021). These effects were absent from the current data. This can be explained by the fact that underlying motive is not the same as behavior itself: individuals motivated to achieve high status may not be able to reach high social or economic positions in society for various reasons. Selection may act on different behaviors related to status (e.g., abilities, social connections, and social dominance) not the status-seeking motivation per se. Furthermore, while the status motivation is a unitary motive, socioeconomic status itself is a complex social condition and its components may have opposite relations on fitness (i.e., education and material wealth: Hackman & Hruschka, 2020).

The variation in slopes in the links between FSMs and fertility between the countries may represent a very important research venue for behavioral ecologists: it may imply that there are ecological conditions (reflected in countries) that moderate the associations between FSMs and reproductive success. However, we would like to refrain from these interpretations in the current case because the data we conducted the analyses upon are not based on representative

samples. If future research based on probabilistic samples would detect the same variation between the countries, then evolutionary anthropologists may propose additional hypotheses on the causes of this variation, that is, economic, social, or cultural moderators of the links between FSMs and reproductive fitness.

A Curious Case of Parental Care

Parental care is a form of parental investment and quantity–quality tradeoff predicts negative association between investment and number of offspring; this association has been captured in some previous studies (Mededović & Petrović, 2019). However, the opposite can be assumed as well—higher parenthood motivation may produce both a higher number of children and higher parental investment. Crucially, the latter is much more plausible in low fertility populations because having fewer children make it easier for parents to maximize care for each of them. The origins of this process can be traced to demographic transition which represented a shift to low fertility—high parental investment in human reproductive ecology (Lawson & Borgerhoff Mulder, 2016). In industrialized

and postindustrialized societies individuals diminished their reproductive success but increased investment in offspring in order to elevate their succession in market economy; since the number of children is lower and investment in every child is typically high, the tradeoff may not be detected on interindividual level. Empirical evidence corroborates this even in traditional populations: tradeoff is visible only when fertility reaches seven children in preindustrial Finnish populations (Gillespie et al., 2008) and in agropastoral Kipsigis (Borgerhoff Mulder, 2000); in the populations of sub-Saharan Africa the tradeoff is evident when fertility is above 10 children per family (Lawson et al., 2012). Indeed, the present findings confirmed this hypothesis; in fact, fixed coefficients of parental care were the highest in comparison to other FSMs. This finding is also in line with the data showing that parental care is related to a lower age of first reproduction (Međedović, 2021a).

Behavioral ecologists often emphasize that the quantity–quality tradeoff may be masked by “phenotypic correlations” that refer to parental resources: the tradeoff is more likely to appear in families where resources are scarce (Gillespie et al., 2008). We tested this interaction as well, but it was not significant. It must be said that parental care in FSMs represents primarily a type of socio-emotional care for children; other forms of parental investment exist and they may be more dependent on parental resources (e.g., economic investment). However, the interaction between parental sex and care for children was found: mothers had higher fitness payoffs if they produced more care and higher fitness detriments if they did not invest, compared to fathers. Although not explicitly presumed, this interaction is in line with the theory of sexual selection on parental care (Trivers, 1972). In many species, females have higher parental care; although humans are largely characterized by biparental care, there are data suggesting that this may stand even for our species (Hofer et al., 2018; Neel et al., 2016). The present data suggest that elevated maternal care may be partly attributed to selection—females that provide more care have higher fitness, and this effect may maintain or even enlarge sex differences in parental care. So far, this remains a hypothesis, the one that should be directly tested in future research which should be based on representative samples.

Limitations and Future Directions

The sample structure was the most important limitation of the present study. As we already stated, the mean age of participants did not enable us to analyze lifetime reproductive success; hence, the indicator of fitness has limitations. Although the sample size was very high and heterogeneous, the samples from each country were not representative ones; this too represents a limitation when discussing selection. The cross-sectional nature of the data prevents us from straightforwardly concluding that the causality goes from motives to fitness because the opposite is possible as well (e.g., individuals may increase their care for other family members after they become parents). Finally, more direct measures of environmental harshness should be used to capture the impact of harsh, depriving, dangerous, and stressful ecologies on the links between FSMs and fitness. Future research may try to overcome these limitations and include other measures of fitness (e.g., number of grandchildren) as well as other moderators, both ecological and individual states that may affect the links between FSMs and fitness.

Concluding Remarks

The current data suggest that FSMs are not only the products of natural selection that emerged in our evolutionary past: they are related to evolutionary fitness in contemporary humans, which may drive their continuous biological evolution. These findings add to the conceptual importance of the FSMs taxonomy in evolutionary human sciences: by examining FSMs we can obtain deeper insights into modern humans’ behavioral evolution. We hope that these findings will encourage other researchers to explore ecological, cultural, and individual characteristics that influence the evolution of FSMs, but also to empirically examine the genetics of FSMs because only the integration of phenotypic and genetic data can give us the full picture of evolutionary trajectories of human motivation.

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