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The Evolutionary Fitness Scale: A Measure of the Independent Criterion of Fitness

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ABSTRACT

The present study aimed at developing a scale comprising the factors thought to be implicated in good-design fitness in humans. Items tapping into dimensions such as health, attractiveness, safety of, and fit with, the environment, resourcefulness, upward mobility, mate value, and extended family were included. The construct showed good internal consistency (Cronbach's alpha = 0.91). As predicted, the construct correlated with measures of physical health, quality of life, social functioning, occupational functioning, and mate value. The scale also showed good discriminant validity, yielding non-significant correlations with religiosity. Implications of the results are also presented.

KEYWORDS

Fitness, Adaptedness, Good-Design, Mate Value, Reproduction, Life-History

INTRODUCTION

Fitness is a fundamental concept in evolutionary biology. Definitions of fitness generally center on two dimensions: one is the outcome (operationalized through reproductive success, or number of offspring), while the other one is the independent criterion, largely referred to as overall adaptedness, that is, properties and capacities that make an organism more successful at reproduction (Michod, 1999).

Definitions that center on the outcome are, for instance, Fagerstrom's (1992) who stated that 'if a set of traits is more fit than another set, then an imaginary gene coding for it spreads faster in the population than does an alternative allele coding for the other set, the rate or increase of the gene being the measure of fitness.' Fisher, (1958) defined fitness as the 'objective fact of representation in future

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generations', while Sober (1993), stated that 'fitter traits increase in frequency, and less fit traits decline'. Rosenberg, (1983) stated that 'the only feature fitness has that could be used in a general characterization of it is its effect on reproduction.'

Definitions of fitness that focus on the independent criterion, or overall adaptedness are, for instance, Dobzhansky's, (1969), who defined fitness as the 'ability of organism to survive and reproduce in an environment.' Likewise, Pianka, (1978) stated that fitness is the 'conformity between the organism and its environment', while Lennox, (1991) defined fitness as 'an explanatory concept referring to a property which is casually relevant to reproductive success.' Burns, (1992) defines fitness as a 'consequence of the adaptedness of an entity to its environment' while Dennett, (1995) states that '*x* is fitter than *y* if and only if *x*'s traits enable it to solve the 'design-problems' set by the environment more fully than *y*'s traits do'.

Purpose of the Study

The aim of this study was to develop a measure that taps into the components of the independent criterion of fitness, or, in Pianka's (1978) definition, the degree of conformity between an organism and the environment. While the difficulty of identifying what makes up good design has been noted by some authors (Rosenberg & Bouchard, 2010), evolutionary psychology does offer some insights that can be operationalized, as detailed in the next sections.

For clarification purposes, henceforth *good-design fitness* is used in this paper as meaning adaptedness, or a constellation of factors, capacities, and traits that enhance reproduction. Likewise, *resultant biological fitness* is used in this paper in the sense of reproductive success.

Preliminary Considerations

Any measure of good-design fitness in humans that seeks to be validated, among others, through success (that is, sheer number of children and/or their quality), will face challenges when tested on populations living in developed areas. Indeed, the positive relationship that existed between resources and fertility in traditional contexts is reversed or has disappeared in the modern societies (Borgerhoff Mulder, 1992; H. Kaplan, Lancaster, Bock, & Johnson, 1995). Historically, a puzzling inverse relationship between economic growth (income levels) and birth rates has been observed. Average fertility in developed countries dropped to below-replacement to just 1.7 births per woman (bpw) in 1990-1995 and this was also observed in other populations, such as Korea, Hong Kong, Thailand, Bahamas, Barbados, or Cuba (United Nations, 1996, p. united). In North America, fertility rates dropped from 3.7 bpw in the 50's to 1.7 bpw in the 80's, to rise modestly to 2.0 after 80's while in Europe and Japan the fertility rates dropped even further to an all-time low of about 1.5 bpw (Bongaarts, 1999). Elsewhere, it was shown that not necessarily increased income levels, but the sheer access to birth control accounted for decline in fertility. In Bangladesh, for instance, which experienced a steep fertility decline from 6.3 bpw in the 70's to 3.4 bpw in the 90's, it was shown that access to control technologies coupled with acceptance of birth control, not economic indicators, accounted for the decline (Cleland, Phillips, Amin, & Kamal, 1994).

The key concept used in the evolutionary approaches to fertility transition is the tradeoff between offspring quantity and quality (Blake, 1989; Blurton Jones, 1987; Hobcraft, McDonald, & Rutstein, 1983; H. Kaplan, 1996; LeGrand & Phillips, 1996).

According to this view, optimal fertility lies at some intermediate level, precisely because most individuals' resources are finite. Reproductive goals include nowadays, like they did in the past, not only the number of children, but also successful and healthy children, which require more resources, therefore smaller family sizes serve such a purpose better (LeGrand, Koppenhaver, Mondain, & Randall, 2003). A study done in Ethiopia, where the difference between bpw in rural versus urban areas is 3, found that a desire to ensure upward mobility of the children was a factor that limited family sizes in urban areas (Sahleyesus, 2005). Such phenomena were also observed in areas characterized by intergenerational transmission of wealth but which are not part of the developing world. A study done in the agropastoral Kipsigis, for instance, documented that extrasomatic capital was a key factor in shaping fertility strategies that centered on quality over quantity (Borgerhoff Mulder, 2000).

All these trends, which are characteristics of modern or developing societies are likely to contaminate the direct effect of adaptedness on number of children and they may even serve as confounding variables for slow Life History (LH) strategies. Slow LH strategies are characterized by greater investment in a smaller number of offspring of higher quality (Figueredo, Vásquez, Brumbach, & Schneider, 2005; Giosan, 2006). If a modern society/group is characterized by reduced fertility, part of this outcome might be related to slow LH strategies, but part of it might be related to the external pressures or trends outlined above.

Due to the reasons presented above, a measure of evolutionary fitness will have to be validated through indirect means such as associations with factors that in the evolutionary psychology literature are thought to be related to fitness.

Construct Development

Human behavior generally targets a finite set of fitness problems, focusing on obtaining successful outcomes in areas such as shelter and security, nutrition and food acquisition, health, sexuality, mate selection, attraction, protection and retention, parenting, and in-group and between-group interaction (Buss, 2015). Evolutionary psychologists note that when humans are successful at meeting these fitness-enhancing goals, they generally experience well-being and happiness (Bailey & Gilbert, 2000). On the other hand, failure (perceived or real) to meet these challenges results in dissatisfaction, depression, tension, or frustration (Bailey & Gilbert, 2000).

These fitness-enhancing domains were used to construct the items of the Evolutionary Fitness Scale (EFS), as detailed below:

Physical Activity. Our ancestors' lifestyle was very active compared to ours. They walked extensively in search for food, had to outrun predators, catch prey and migrate frequently. Contemporary humans engage in little physical exercise compared to the physically active lifestyle engaged in by ancestral hunter-gatherers (Cordain, Gotshall, & Eaton, 1997; Lima et al., 2008; O'Keefe & Cordain, 2004; Walker & Adam, 2003). Not surprisingly, ample research documents the beneficial effects of physical activity on health (Biddle & Asare, 2011; North, McCullagh, & Tran, 1990), as well as for general mental health (Clyne, 2001). Generally, participants engaging in regular physical activity display more desirable health outcomes across a variety of physical conditions (Penedo & Dahn, 2005). Similarly, participants in randomized clinical trials of physical-activity interventions show better health outcomes, including better general and health-related quality of life, better functional capacity and better mood states (North et al., 1990; Penedo & Dahn, 2005).

Nutrition. Our ancestors' diet consisted primarily of fruits (e.g., apples, tomatoes, berries), non-starchy vegetables (e.g., cabbage, lettuce), nuts (e.g., hazelnuts, walnuts), occasional honey, eggs, and game meat. The typical pre-agricultural diet was virtually free of legumes (e.g., potatoes or beans), dairy products or grains. The very little – if any – amounts of grains our ancestors consumed were in the form of sprouts, i.e., grains that could be eaten raw, uncooked. Our ancestors' vitamin intake was considerably higher than ours and the meat our ancestors consumed had considerably lower amounts of saturated fat compared to farmed meat. The glycemic index of the typical foods our ancestors consumed was very low compared to the modern foods and they typically enjoy better health than people living in modern societies (O'Dea, 1991; O'Keefe & Cordain, 2004).

Studies and metaanalyses have documented the positive benefits of consuming staple foods characteristic of hunter-gatherers lifestyles (Cordain et al., 2005; Manheimer, van Zuuren, Fedorowicz, & Pijl, 2015). Low potassium intake – notoriously present nowadays but virtually inexistent in hunter gatherer populations - has been linked to an increased risk for hypertension (Kieneker et al., 2014) while high fat and/or high salt intake during pregnancy can alter maternal meta-inflammation and offspring growth (Reynolds, Vickers, Harrison, Segovia, & Gray, 2014). Nuts consumption (rich in unsaturated fats) has been negatively linked to the risk of cardiovascular disease (Luo et al., 2014).

Health (both of the actor, his/her partner, and their extended families). People who are healthy (and who can maintain it in the modern societies by having access to good health care), should have increased chances, as they had in the past, of passing on their genes to the next generation both because they live longer and because they may be more preferred as mates. Unhealthy individuals are at increased risks of becoming debilitated, dying, or transferring communicable disease to their mates and/or offspring (Buss, 2015). In a study of 37 cultures, Buss et al., (1990) found that health is judged to be highly important by both men and women, while in studies of parenting, health of the offspring was associated with more parental investment (Mann, 1992, p. mann).

Attractiveness (both of the actor, and his/her partner). Attractiveness is associated with increased health and fertility. In women, for instance, a low waist-to-hip ratio – which is directly related to a woman's body attractiveness – has been associated with increased fertility and health (Singh, 1993). Moreover, it has been shown that attractiveness is associated with increased likelihood of marrying in females (Udry & Eckland, 1984). In men, judgments of health were associated with facial symmetry (Johnston, Hagel, Franklin, Fink, & Grammer, 2001). Symmetry in men was also associated with psychological and physiological health (e.g., Shackelford & Larsen, (1997) and it was documented that women value this quality highly in their mates (Gagenstad & Thornhill, 1997; Thornhill & Møller, 1997).

Status, Dominance, and Resource Control. Upward mobility (both social and financial) is an important factor universally preferred in mates, especially in men, and associations between male status and accessibility to desirable mates are well-documented (Betzig, 1993; Elder, 1969; Grammer, 1992; Pérusse, 1993). Men also gain status by dating an attractive woman (Sigall & Landy, 1973). While financial and upward mobility are status enhancer factors in men, in women status has been linked to their beauty (Wright, 1982). Also, women, more often than men, gain status by 'marrying up'. A man's looks do not predict the financial status of his future mate, while a woman's looks do correlate with the status of her husband (Elder, 1969; Taylor & Glenn, 1976). Moreover, status may serve not only the purpose of attracting more desirable mates: elsewhere, it has been shown that increased status is linked to increased resistance to communicable infectious diseases, especially respiratory infections, in both humans and monkeys (Cohen, 1999) and that children from lower classes are more likely to develop them (Graham, 1990; Power, 1992) and to miss school days because of such illnesses (Egbuonu & Starfield, 1982). All this body of research suggests that status can mediate reproductive success in different ways, such as resources available to invest in offspring, or better parental and offspring health.

Extended Family. The inclusive fitness theory proposed that resultant biological fitness is acquired not only through investments in one's own offspring, but also in their relatives who carry copies of their genes (Hamilton, 1964). Access to the resources of the extended family should therefore increase reproductive success. The 'grandmother hypothesis' even states that inclusive fitness can explain increased longevity in people who are well past their reproductive years (Hill & Hurtado, 1989). In short, having access to the investment of the extended family – which is sometimes challenging in our mobile world – should increase resultant fitness, as one's offspring would receive extra care and investment.

Environmental Fit. There is well-documented evidence that people tend to choose their spouses and friends from people similar to them (Rushton, 1989). People tend to rate their own morphed faces as being more attractive (Voak, Perrett, & Peirce, 1999). Other studies showed that couples who produced a child together were 52% similar with respect to 10 blood groups, as opposed to couples who did not produce a child together, who were only 44% similar (Rushton, 1988). Being in environments where similar people are around should increase resultant fitness and should therefore be a dimension in a measure of evolutionary fitness.

Environmental Safety: living in areas with high crime rates, or having life-threatening jobs, or being unable to escape when in danger are factors that can adversely affect biological fitness. Therefore, managing to live and work in safe conditions, or having the resources to manage dangerous situations successfully should be components of adaptedness.

Social Capital. Humans are a very social species and survival and reproduction have been affected by social interactions in cooperative and coalitional relationships (Axelrod, 1984; Axelrod & Hamilton, 1981; Williams, 1966). Cooperation is widespread in nature (de Waal, 1982; Packer, 1977; Wilkinson, 1984) and in humans (Sugiyama & Sugiyama, 2003). Cultivating uniqueness, irreplaceability, and individuality, in a network of individuals whom one can rely on when in need should therefore positively affect fitness (Tooby & Cosmides, 1996).

Mate Value. Mate value has been linked to increased number of sexual partners and generally a more promiscuous path in a sample of US males (Lalumiere, Seto, & Quinsey, 1995; Landolt, Lalumière, & Quinsey, 1995). While the components that make up mate value are relatively different in males and females, in that men acquire it through status, prestige, intelligence, interpersonal dominance, popularity, athleticism, while women acquire it primarily through attractiveness and age, the end result is the same: greater mate value is associated with increased mating opportunities from a larger and more desirable mating pool. Therefore, mate value is a critical component of adaptedness.

Environmental Resemblance to Natural Environments. A preference for natural environments has been documented in the literature (S. Kaplan, 1992; S. Kaplan & Kaplan, 1982; Ulrich, 1983) and lower physiological distress is associated to viewing slides of nature scenes (Ulrich, 1986). Having the possibility to live in environments that resemble the ancestral ones is likely to alleviate stress and generally improve well-being(Appleton, 1975; Ulrich, 1984; Watson & Burlingame, 1960). Being resourceful enough to live in such places, which, in an evolutionary sense, may mean multiple places for concealment and multiple routes for escape, should therefore factor in good-design fitness.

Fifty-eight items that assessed the perception of personal adaptedness as well as that of the partner and offspring were developed into an Evolutionary Fitness Scale (EFS) (see Appendix 1). A pilot study on 20 respondents revealed no issues with the wording of any particular item.

Hypotheses

The proposed Evolutionary Fitness Scale is theorized to assess personal adaptedness as well as partner and offspring adaptedness, therefore it is expected that the items will have high internal consistency.

Hypothesis 1: The internal consistency of the EFS items will be high. EFS is theorized to tap into occupational and social functioning, therefore it is expected that it will correlate with measures of functioning.

Hypothesis 2: EFS will show a significant correlation with measures of occupational and social functioning. Adaptedness represents one’s ability to ensure the survivability of his/her genes. Access to desirable mates is central to achieve this purpose. Therefore, a measure of overall fitness should correlate with mate value.

Hypothesis 3: EFS is associated with mate value. As argued in the earlier sections, health is a dimension of adaptedness. It is therefore expected that a measure of evolutionary fitness will be associated with actual health and physical status indicators. It is hypothesized, therefore, that:

Hypothesis 4: EFS is associated with physical health.
Hypothesis 5: EFS is associated with physical fitness.

Finally, EFS is theorized to tap into domains that are related to the success of a person. Therefore, high scores at the EFS should be associated with quality of life.

Hypothesis 6: EFS is associated with quality of life.

To test for discriminant validity a measure of religiosity was chosen, which theoretically should not be associated with a measure of overall fitness. Therefore, the final hypothesis tested in this study is:

Hypothesis 7: EFS will show no significant associations with religiosity.

METHOD

Participants

The scale was tested on a sample of 146 respondents. The participants were undergraduate students at a college on the East Coast of the US, who completed the measures in exchange for course credit. The institution's Ethics Committee approved the study.

Measures Administered

1) **The Evolutionary Fitness Scale.** The 58-item scale is presented in Appendix 1. The items were coded on a 5-point Likert scale, from 'strongly disagree' to 'strongly agree'.
2) **The Social Adjustment Scale (SAS-SR SAS)** (Weissman et al., 1978, 1999, 2001). The SAS-SR is a self-report measure of social functioning used both in research and clinical practice. The questions are designed to assess six role areas: (1) work, (2) social and leisure activities, (3) relationships with extended family, (4) role as a marital partner, (5) parental role, and (6) role within the family unit. Each question is rated on a five-point scale from which role area means and an overall mean can be obtained, with higher scores denoting greater impairment (Gameroff, Wickramaratne, & Weissman, 2012).
3) **The Mate Value Inventory (MVI)** (Kirsner, Figueredo, & Jacobs, 2003) is a multivariate assessment of attributes desired in self, social or sexual partners. The MVI consists of a list of 17 traits, and mate value is calculated by summing up the score of the items.

4) **Physical Health Questionnaire (PHQ).** PHQ is a brief self-report scale used to assess somatic symptoms (Schat, Kelloway, & Desmarais, 2005). It has four empirically distinct dimensions: gastrointestinal problems (α = .83), headaches (α =.88), sleep disturbances (α =.80), and respiratory illness (α =.66). The scale has good construct validity and its subscales correlate with measures of negative affect, psychological health, and job performance, providing further validity of its scores (Schat et al., 2005). Responses are collected on a seven-point Likert-type scale ranging from 1 ("not at all") to 7 ("all of the time"). Scores for overall physical health are computed by averaging the responses, with higher scores indicating greater severity.
5) **The WHO Quality of Life BREF (WHOQOL-BREF)** (Skevington, Lotfy, & O'Connell, 2004; The Whoqol Group, 1998) comprises 26 items assessing physical and psychological health, social relationships, and environment. Analyses of internal consistency, item–total correlations, discriminant validity and construct validity through confirmatory factor analysis, indicate that the WHOQOL-BREF has good to excellent reliability and performs well in preliminary tests of validity (Skevington et al., 2004). Scores for overall quality of life are computed by averaging the responses, with higher scores indicating greater quality of life.
6) **The International Fitness Scale** (Ortega et al., 2011). This four-item scale, coded on a 5-point Likert, asks respondents to compare their perceived overall fitness, cardiorespiratory fitness, muscular strength and speed/agility (motor fitness) with their peer's physical fitness (very poor, poor, average, good and very good). The measure is an effective tool able to correctly rank adolescents according to their measured physical fitness levels (Ortega et al., 2011), and correlates highly with an actual cardiovascular profile, muscular fitness and speed and agility measured via field-based fitness tests, and with predicted cardio-vascular disease risk measured via physical examination, blood pressure and blood biochemical analyses. Scores for overall fitness were computed by averaging the responses, with higher scores indicating higher physical fitness.
7) **Components of Mate Value Survey (CMVS)** (M. Fisher, Cox, Bennett, & Gavric, 2008) (Fisher, Cox, Bennett, & Gavric, 2008) is a 21-item, self-report measure. It was designed based on the Self-Perceived Mating Success Scale (Landolt et al., 1995) (Landolt, et al., 1995), but besides aspects of mate value indexed by SPMSS, the CMVS includes aspects related to sociality, parenting, wealth, looks, relationships history, and fear of failure. Adequate reliability was obtained for the 21 items and significant correlations of CMVS with MVI (Kirsner et al., 2003) (Kirsner, et al., 2003) were obtained.
8) **The Santa Clara Strength of Religious Faith Questionnaire** is a brief, reliable and valid self-report measure assessing strength of religious faith and engagement suitable for use with multiple religious traditions. It has been widely used in medical, student, psychiatric and general populations internationally and among multiple cultures and languages and it enjoys good psychometric properties (Plante, 2010; Plante & Boccaccini, 1997; Storch, Roberti, Bravata, & Storch, 2004).

Statistical Approach

Descriptive statistics were computed for demographic variables using frequencies and percentages for categorical variables and means/standard deviation or medinas/range for continuous variables. The total EFS score was computed by summing up the first 45 items of the scale and dividing that number by 45 in case the respondent did not have children, or summing up all 58 items and dividing by 58 in case the respondent had children. Items 5, 54, 56 and 57 were reverse-coded to conform to all the other positively-worded items. Item–total correlations were computed for all items and internal consistency was evaluated using the Cronbach's alpha coefficient. Exploratory factor analysis was conducted using principal component estimation method and oblique rotation. The number of factors was chosen based on factor loading patterns and overall interpretability. Convergent and discriminant validity was assessed using Pearson's correlation coefficients.

RESULTS

Demographics and EFS Score

Table 1 depicts the demographic characteristics of the sample (N = 146). A third of the sample was male. The sample's mean age was 26.80 (S.D. = 8.20).

Table 1.

Sociodemographic Characteristics

Characteristics of Sample (N=146)	
Age, years, mean (SD)	26.80 (8.20)
Number of children, % (n)	
None	78.8 (115)
One	11.0 (16)
2 or more	10.4 (15)
Age of children, years, median (range)	11.00 (1-37)
Gender, % (n)	
Male	34.2 (50)
Female	65.8 (96)
Race, % (n)	
Caucasian	15.8 (23)
African American	36.3 (53)

Hispanic	26.0 (38)
Asian	13.7 (20)
Other	8.2 (12)
Marital Status, % (n)	
Married or cohabitating	19.2 (28)
Divorced	6.8 (10)
Single	70.5 (103)
Other	3.4 (5)

Of the 146 respondents, 78.8% reported having no children. The mean EFS score in this sample was 3.40 (S.D. = .51).

Internal Consistency

The reliability coefficient in this sample was high, suggesting that the items are internally consistent (Cronbach's α = .92, number of items = 58), supporting Hypothesis 1. Item-total correlations ranged from modest .06 for item 10 ("My health coverage is enough to pay for any unexpected medical bills") to .57 ("I am satisfied with my sex life with my partner"). Removing any item from the scale did not change Cronbach's α, therefore all the items were retained in the scale (Table 2).

Factor Structure

An EFA performed on the items showed that a two-factor solution had the best interpretable fit with the data. The two factors accounted for 36.57% of the variance (eigenvalues were 10.04 and 11.17 respectively). Items 1-37 converged to Factor 1, which can be interpreted as personal adaptedness (all items except items 5 and 10 exhibited strong loadings on Factor 1) (Table 2). In addition, predictably, items 38-58 (which tap into partner and offspring fitness) cross-loaded on Factor 2.

Table 2.

Item statistics and EFA results

Item	Item-Total Correlation (Corrected)	Cronbach's Alpha if Item Deleted	Factor 1	Factor 2
1	0.19	0.92	**.602**	.056
2	0.34	0.92	**.573**	.223
3	0.36	0.92	**.523**	.260
4	0.45	0.91	**.455**	.397
5	0.10	0.92	**.239**	.032

6	0.31	0.92	**.409**	.235
7	0.37	0.92	**.606**	.251
8	0.22	0.92	**.152**	.202
9	0.51	0.91	**.462**	.419
10	0.06	0.92	**.106**	.019
11	0.44	0.91	**.377**	.393
12	0.31	0.92	**.345**	.256
13	0.42	0.92	**.385**	.383
14	0.36	0.92	**.433**	.278
15	0.46	0.91	**.453**	.381
16	0.20	0.92	**.367**	.106
17	0.24	0.92	**.292**	.198
18	0.45	0.91	**.326**	.411
19	0.24	0.92	**.242**	.210
20	0.27	0.92	**.318**	.225
21	0.27	0.92	**.419**	.208
22	0.28	0.92	**.412**	.213
23	0.30	0.92	**.371**	.257
24	0.46	0.91	**.271**	.444
25	0.26	0.92	**.302**	.249
26	0.39	0.92	**.153**	.407
27	0.50	0.91	**.573**	.406
28	0.25	0.92	**.583**	.148
29	0.40	0.92	**.520**	.319
30	0.50	0.91	**.513**	.428
31	0.49	0.91	**.491**	.421
32	0.38	0.92	**.585**	.272
33	0.41	0.92	**.562**	.302
34	0.30	0.92	**.296**	.284
35	0.30	0.92	**.397**	.243
36	0.46	0.91	**.582**	.354
37	0.39	0.92	**.607**	.280
38	0.53	0.91	-.064	**.561**
39	0.57	0.91	-.077	**.604**
40	0.56	0.91	-.077	**.596**
41	0.55	0.91	-.121	**.586**
42	0.54	0.91	-.099	**.579**

43	0.56	0.91	-.065	**.592**
44	0.55	0.91	-.077	**.587**
45	0.49	0.91	-.166	**.544**
46	0.44	0.91	-.388	**.614**
47	0.40	0.92	-.566	**.625**
48	0.37	0.92	-.536	**.594**
49	0.49	0.91	-.422	**.677**
50	0.43	0.91	-.474	**.631**
51	0.35	0.92	-.523	**.564**
52	0.39	0.92	-.398	**.588**
53	0.45	0.91	-.488	**.680**
54	0.40	0.92	-.469	**.628**
55	0.45	0.91	-.486	**.681**
56	0.37	0.92	-.463	**.597**
57	0.45	0.91	-.430	**.664**
58	0.43	0.91	-.504	**.672**

Note: Extraction Method: Principal Component.

Construct Validity

Convergent validity: The next step in the statistical analyses was to correlate the total EFS score with the scores of the measures theorized to be associated with it.

To this end EFS correlated significantly with:

a) SAS-SR ($r = -.57$, $p < .001$), confirming Hypothesis 2.
b) Mate Value Inventory ($r = .55$, $p < .001$) and CMVS ($r = .67$, $p = .001$), confirming Hypothesis 3.
c) Physical health ($r = -.33$, $p = .001$), confirming Hypothesis 4.
d) Physical fitness ($r = .57$, $p = .001$), confirming Hypothesis 5.
f) Four domains of quality of life ($r = .51$, $r=.65$, $r=.61$ and $r=.59$, all $p < .001$), confirming Hypothesis 6.

Discriminant validity: EFS did not show significant correlations with religiosity, confirming Hypothesis 6 ($r = .08$, $p = .333$).

The full correlation matrix is presented in Table 3.

Table 3.

Correlation Matrix

	2	3	4	5	6	7	8	9	10	11	12	13
1. EFS	-0.04	0.00	-.57**	.55**	.67**	-.33**	.57**	.51**	.65**	.61**	.59**	0.08
2. Age	1	.55**	-0.06	-0.02	-0.22**	-0.14	0.13	0.09	0.07	-0.07	0.02	.25**
3. Children		1	-0.09	0.01	-0.11	0.02	0.10	0.06	0.03	-0.04	0.02	0.16
4. SAS-SR			1	-.35**	-0.42**	.39**	-.40**	-.58**	-.65**	-.53**	-.54**	0.02
5. MVI				1	0.51**	-.34**	.29**	.42**	.51**	.44**	.39**	.19*
6. CMVS					1	-.22*	.34*	.38*	.44*	.41*	.37*	0.06
7. PHQ						1	-.38**	-.54**	-.48**	-.27**	-.64**	-.22*
8. IFS							1	.38**	.35**	.28**	.36**	0.05
9. WHOQOL-BREF D1								1	.76**	.55**	.91**	0.14
10. WHOQOL-BREF D2									1	.67**	.75**	.17*
11. WHOQOL-BREF D3										1	.58**	0.1
12. WHOQOL-BREF D4											1	0.14
13. SCR												1

DISCUSSION

This study presents a preliminary validation of a scale of adaptedness, or good-design fitness, which was conceptualized as the independent criterion of fitness. It was hypothesized that the scale will be associated with factors that are thought to be linked to reproductive success in the evolutionary psychology literature. Indeed, the construct showed the predicted associations with occupational and social functioning, physical health and fitness, mate value and quality of life.

Although the results of this study are promising, some caveats are in order. Firstly, the sample consisted of undergraduate students, which may be less representative for measuring fitness than older adults. A substantial proportion of the participants reported having no partners, which has had an impact on the factorial analyses performed. Also, the fact that our sample consisted of undergraduate students raises questions about generalizability to other US populations. Further research needs to be done to investigate the ecological validity and robustness of this scale, by testing it on different US populations (e.g., older adults). Related to this, the scale was tested on a US sample, which may raise questions about cross-cultural generalizability. Moreover, the proposed scale assesses perceived fitness via a self-report and it is unclear how accurate people's perceptions about their own fitness are.

Last, but not least, another major potential issue with the proposed Evolutionary Fitness Scale is that some of its dimensions tap into factors that measures of slow Life History also tap into. For instance, a slow Life History strategy is characterized by resource acquisition, personal and offspring health and quality, or upward mobility (Figueredo et al., 2005; Giosan, 2006). The proposed Evolutionary Fitness Scale also taps into these domains, among others, which may raise the issue of construct overlap. However, the EFS is conceptualized to evaluate overall fitness (a deep-level construct), rather than specific reproductive strategies (mid-level constructs). The argument in the present study is that higher scores on the EFS suggest higher overall fitness, a prerequisite of reproductive success that can be achieved via different strategies. To this end, the scale correlates with mate value, which has been shown elsewhere to correlate with number of sexual partners and short-term mating strategies in males (Clark, 2006) – components of a fast LH. Likewise, some of the domains captured by EFS that are thought to relate to slow LH, such as resource acquisition or upward mobility, have been found elsewhere to correlate with increased number of sexual partners, at least in men (Kanazawa, 2003; Perusse, 1993), again elements suggestive of a fast LH. Even specific measures of slow LH have shown some intriguing positive correlations with number of children or number of sexual partners (Copping, Campbell, & Muncer, 2014; Giosan, 2006).

All of these suggest the enormous difficulty of evaluating and operationalizing constructs like general fitness. Much more research needs to be done to clarify the intricate relationships between reproductive strategies and general fitness, as well as gender differences along these dimensions.

Despite these caveats and limitations however, the study presents, for the first time in the evolutionary psychology literature, a preliminary validation of an evolutionary theory-driven measure that assesses the perceptions of the indicators that are thought to make up the independent criterion of fitness in humans. The results of this study suggest that the perceptions of the indicators that make up adaptedness are relatively accurate. Based on these findings, it can be speculated that humans have developed mechanisms of assessing their degree of adaptedness to the environment, which may have a bearing on reproductive success.

Directions for Further Research

There are multiple directions for further research in this inquiry line, some of which stemming from this study's limitations. One avenue is testing the associations between this construct and number/quality of sexual partners, used as proxy for number of children. Because of ethical concerns, this important information could not be collected in the current study. Examining whether adaptedness as measured by this scale is correlated with increased sexual access and/or access to more desirable mates, in a society where birth control and social pressures against having many children are the norm rather than the exception, can further validate this construct.

Another avenue of research is to examine the relationships between this scale and objective measurements of offspring quality, such as health records, school/job performance records, income, and, very importantly, number and quality of grandchildren. Longitudinal studies are required to address this latter relationship.

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Appendix A

1. I have at least one best friend.

2. In general, my extended family members, especially my first-degree relatives, have enjoyed great longevity.

3. I have many friends ready to help me in case of need.

4. I eat very healthy.

5. I have significant medical problems.

6. I may not be a millionaire, but I make enough money to afford many of the things I want.

7. People find me sexually attractive.

8. I engage in activities, at my job or elsewhere, that put my life at risk.

9. I am generally satisfied with my sex life.

10. My health coverage is enough to pay for any unexpected medical bills.

11. I visit my relatives frequently.

12. I am not afraid of intrusions or burglaries in the house I live.

13. I often get the chance spend time outside.

14. I am more attractive to potential sexual partners than the majority of my peers.

15. I am an active outdoors person.

16. I get to tend to pets and animals often.

17. I like to gather wild strawberries and other edible things from nature when given the opportunity.

18. I eat at least three servings of vegetables or fruits per day.

19. I eat nuts frequently.

20. I eat plenty of fish.

21. I get enough sleep.

22. Most of the days I eat lean meats (e.g., chicken breast) rather than fat cuts.

23. I exercise at least four times a week.

24. I am in a better physical shape than the majority of people my age.

25. I am not afraid to walk at night in my neighborhood.

26. I have the ability to protect me and my family in case of natural disasters or accidents (e.g., flood, fire).

27. I would find a date easily, if I wanted to.

28. I frequently go out with my friends.

29. I fit well with my coworkers.

30. The circumstances in which I find myself now are a good match with my personal goals and aspirations.

31. I fit well with my neighbors.

32. My family members brag about me.

33. I am admired by my friends.

34. I help many people.

35. I am important to people other than my family.

36. My friends contact me often.

37. My family contact me often.

38. I believe people find my partner more attractive than the majority of his/her peers.

39. I am satisfied with my sex life with my partner.

40. My partner and I are very compatible sexually.

41. I believe my partner is faithful to me.

42. My partner enjoys good health.

43. I have a harmonious, conflict-free, relationship with my partner.

44. If I made no money, I could rely on my partner's income for a while without a significant drop in my quality of life.

45. If I wanted to, my partner would have a child with me.

If you have children, please fill out the following items:

46. My relatives would take care of my children, in case of need.

47. My children are better at sports than the majority of their peers.

48. My children are in top 10% at school.

49. I could count on my close friends to take care of my children in case of need.

50. My children rarely get sick.

51. People say my children are very cute.

52. I am pleased with my child's boyfriend/girlfriend selection.

53. I have a close relationship with my children.

54. My children's ideas often irritate me.

55. My children confide in me.

56. I get into frequent arguments with my children.

57. I don't like my children's friends.

58. My children trust and follow my advice.