

Original Article

High-K Strategy Scale: A Measure of the High-K Independent Criterion of Fitness

Cezar Giosan, Department of Psychiatry, Weill Medical College of Cornell University, New York, NY 10021 E-mail: cezar@giosan.com

Abstract: The present study aimed at testing whether factors documented in the literature as being indicators of a high-K reproductive strategy have effects on fitness in extant humans. A 26-item High-K Strategy Scale comprising these factors was developed and tested on 250 respondents. Items tapping into health and attractiveness, upward mobility, social capital and risks consideration, were included in the scale. As expected, the scale showed a significant correlation with perceived offspring quality and a weak, but significant association with actual number of children. The scale had a high reliability coefficient (Cronbach's Alpha = .92). Expected correlations were found between the scale and number of medical diagnoses, education, perceived social support, and number of previous marriages, strengthening the scale's construct validity. Implications of the results are discussed.

Keywords: Fitness, adaptedness, high-K, life history theory, r/K, number of children, offspring quality

Introduction: Fitness is a fundamental concept in evolutionary biology. Definitions of fitness generally center on two dimensions: One is the resultant biological fitness, operationalized through reproductive success, or number of offspring, (e.g., Fagerstrom, 1992; Fisher, 1958; Rosenberg, 1983; Sober, 1993), 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 (e.g., Burns, 1992; Dennett, 1995; Dobzhansky, 1969; Lennox, 1991; Michod, 1999; Pianka, 1978).

The strategies by which an organism achieves resultant fitness are varied. Life History Theory (LHT) (e.g., Bogaert and Rushton, 1989; Figueredo et al., 2006; MacArthur and Wilson, 1967; Pianka, 1970), states that, for any given individual, the available resources in any particular environment are finite, which translates in trade-offs in the allocation of energy to solve particular fitness-relevant tasks. Thus, an individual can allocate resources for somatic effort (e.g., growing a larger body), or reproductive

effort (pursuing mates or investing in offspring). The extremes of these fundamental dimensions of reproduction are traditionally termed the r/K theory. A K-selection strategy is to produce a smaller number of 'fitter' offspring with higher chances of survival, while an r-selected strategy is the production of a large number of offspring, of whom only a minority may survive (e.g., Bogaert and Rushton, 1989; Figueredo et al., 2006). These different co-adapted reproductive strategies result from psychosocial traits that cluster together (e.g., Rushton, 1985; Thornhill and Palmer, 2004).

Examples of high K-strategists are elephants, humans, or whales. When applied to humans, LHT is referred to as "differential K" (Rushton, 1985). Traits associated with a high-K strategy in humans are long-term thinking and planning, commitment to long-term relationships, extensive parental investment, existence of social support structures, adherence to social rules (e.g., altruism and cooperation), and careful consideration of risks (Figueredo et al., 2006).

Purpose of the study

The aim of the present study was to develop a high-K fitness optimization model. To this end, a measure tapping into the high-K independent criterion of fitness (i.e., high-K strategies) was developed and associations with certain fitness outcomes, such as quality and number of offspring, were tested.

Construct development and predictions

A scale that taps into the components of a high-K reproductive strategy should have the following characteristics:

- 1) The items should be reflections of factors documented in the evolutionary psychology literature as being related to high-K (e.g., upward mobility, health, social capital, consideration of risks).
- 2) Since a high-K strategy is theorized to translate into increased parental investment in the offspring, with the aim of making them more competitive, a significant correlation between the construct and the perceived quality of the offspring is expected.
- 3) High-K strategists emphasize on the quality, rather than quantity, of the offspring, therefore the construct should show small correlations with actual resultant biological fitness (number of children).
- 4) LHT tells us that many fitness-enhancing traits should be negatively correlated, but traits consistent with a single coherent reproductive strategy should be positively correlated. The present construct is conceptualized to tap into one coherent reproductive strategy, high-K, therefore it should enjoy high internal consistency.
- 5) High-K strategists invest in somatic effort, educational opportunities and social capital, therefore significant correlations between the construct and health, educational level, and social support are also expected.
- 6) High-K strategists are also committed to long-term relationships therefore a negative correlation between the construct and number of previous marriages is expected.

Scale content

In our modern society, a high-K strategy can be realized through: 1) preserving or increasing health of self, offspring and kin, 2) achieving upward mobility, which may translate into better access to healthcare and educational and career opportunities for the offspring, 3) social capital, which may translate into receiving help from others when in need and 4) careful consideration of risks, (e.g., securing safe shelter or avoiding risky activities). The scale content was thus centered on these factors, described in more detail below:

- 1) **Health and attractiveness:** High-K strategists invest in somatic effort, which should translate into better health and increased lifespan (Figueredo et al., 2006). Health and fertility in women were associated with attractiveness (Singh, 2003), which, in turn, was associated with increased likelihood of marrying (Udry and Eckland, 1984). In men, judgments of health were associated with facial symmetry (Jones et al., 2001), which, in turn, was associated with psychological and physiological health (e.g., Shackelford and Larsen, 1997). Unhealthy individuals are at increased risks of becoming debilitated, dying, or transferring communicable disease to their mates and/or offspring (Buss, 2004). In a study of 37 cultures, Buss, et al., (1990) found that health was 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). Health can be maintained not only through active somatic effort: A preference for natural environments, which, in evolutionary sense, may mean multiple places for concealment and multiple routes for escape, has been documented in the literature (Kaplan, 1992; Kaplan and Kaplan, 1982; Ulrich, 1983), and lower physiological distress and quicker recovery from surgery, for instance, were associated with viewing nature scenes (Ulrich, 1986). Thus, living in such “evolutionarily healthy” environments is likely to alleviate stress (Appleton, 1975; Ulrich, 1984; Watson and Burlingame, 1960), and generally improve well-being, which should translate into positive effects on fitness.
- 2) **Upward mobility.** Upward social and financial mobility are important factors universally preferred in mates, especially in men, and associations between male status and accessibility to desirable mates are well-documented (e.g., Betzig, 1993; Elder, 1969; Grammer, 1992; Perusse, 1993). Upward mobility is a status-gaining factor in men, but female beauty enjoys higher status than men’s in the mating world (Wright, 1982). Status serves 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 (e.g., Cruz et al., 1990; Power, 1992) and to miss school days because of such illnesses (Egbonu and Starfield, 1982). All this body of research suggests that status and resource control can mediate reproductive success in

different ways, such as resources available to invest in offspring, or better parental and offspring health.

- 3) **Social capital and extended family.** Inclusive fitness theory proposed that fitness is realized 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 (e.g., time, caregiving, money) of one's extended family increases fitness. The 'grandmother hypothesis' even states that inclusive fitness can explain increased longevity in people who are well past their reproductive years (Hill and Hutardo, 1989). High-K strategists invest in somatic effort, which increases their likelihood to have an extended lifespan and thus to increase inclusive fitness through grandparenting (Figueredo et al., 2006). Humans are also a very social species, and survival and reproduction have been affected by social interactions in cooperative and coalitional relationships, which in many cases are not blood-related, but are based on similar values and goals (Axelrod, 1984; Axelrod and Hamilton, 1981; Williams, 1966). High-K strategists maintain and cultivate substantial social support structures and adhere to social rules such as cooperation and altruism (Figueredo et al., 2006). Cultivating uniqueness, irreplaceability, and individuality, in a network of individuals whom one can rely on when in need should affect fitness positively, as this may attract more help from others (Tooby and Cosmides, 1996). In short, having social capital, access to the investment of the extended family – which is sometimes challenging in our mobile world -, and belonging to a network of people with similar values, interests, and goals, should increase fitness, as one's offspring is likely to receive extra care and investment.
- 4) **Consideration of risks.** High-K strategists display careful consideration of risks (Figueredo et al., 2006). Living or working in unsafe places are likely factors that can decrease fitness because of health consequences or direct threats to the survival of self or kin. Channeling resources and efforts to avoid working or living in such places should have positive effects on fitness.

Twenty-six items tapping into these factors were developed into a High-K Strategy Scale (HKSS) (see Appendix 1). A pilot study on 20 people revealed no issues with the meaning of any particular item.

Analytical strategy

HKSS total score was calculated by summing up the items. Health was operationalized by summing up all the non-similar diagnosis categories the respondent sought medical assistance for in the past five years through his/her employer's occupational health services, therefore, a higher number of such diagnoses was seen as indicative of poorer health. This coding modality was chosen over summing up the sheer number of diagnoses, because it was unclear when similar diagnoses or diagnosis categories related to independent similar medical conditions or to multiple medical visits for the same condition.

Correlations between total HKSS score and offspring quality, resultant fitness, education, number of medical diagnoses, perceived social support, and number of previous marriages were then tested, and Cronbach's Alpha was also calculated.

Method

Participants

The scale was tested on a sample of 250 respondents. Participants were full-time utility workers of a utility company in Northeast America. Permission was obtained to administer these measures as a part of these respondents' mandatory annual health assessment, therefore the return rate was 100%. Demographic information, including self-reported number of children, and health records obtained from their employer's occupational health service, were also collected. The turnaround time was approximately a month.

Measures administered

- 1) *High-K Strategy Scale (HKSS)*. The 26-item scale is presented in Appendix 1. The items were coded on a 5-point Likert scale, from "strongly disagree" to "strongly agree", with the exception of one item – item nr. 19, "Are you married or cohabitating?" - which was coded dichotomously (no = 1 and yes = 5).
- 2) *Interpersonal Support Evaluation List (ISEL)* (Cohen and Hoberman, 1983; Cohen et al., 1985), is a 40-item measure of perceived availability of social support, which has good internal consistency (Cronbach's Alpha = .88).
- 3) *Perceived offspring quality*. This short scale was developed by the author and consisted of three items tapping into three components: health, intelligence/industriousness, and physical ability of the offspring. The items were "My children did not take many days off from school for medical reasons", "My children do/did well in school", and "My children are good at sports". The items were coded on a five-point Likert scale from "strongly disagree" to "strongly agree". The Cronbach's Alpha for this three-item scale was acceptable (Cronbach's Alpha = .76).

Results

Demographics and HKSS score

Table 1 depicts the demographic characteristics of the sample ($N = 250$). Overall, the sample consisted of primarily middle-aged, white, married men with the majority having at least a high-school education. The mean number of children the sample reported was 1.68 ($SD = 1.29$) and the mean age of the children of the respondents was 16.98 ($SD = 8.54$).

Of the 250 respondents, 25.6% reported having no children, 16.8% reported having one child, 30.8% reported having two children, 17.2% reported having three

children, and 9.6% reported having four or more children. The mean HKSS score was 81.45 ($SD=13.83$).

Construct validity

The next step in the analyses was to correlate the total HKSS score with perceived offspring quality and number of children. As expected, HKSS correlated highly significantly with perceived offspring quality ($r = .46, p = .001$), and showed a small correlation with number of children ($r = .16, p = .01$). Next, correlations between HKSS and number of medical diagnoses, education, and perceived social support, were tested. HKSS correlated significantly with number of medical diagnoses ($r = -.14, p = .05$), with education ($r = .21, p = .001$), and with perceived social support ($r = .53, p = .001$). Finally, correlations between HKSS and number of previous marriages were performed. HKSS correlated significantly with number of previous marriages ($r = -.14, p = .05$).

Table 1. Sociodemographic Characteristics

Characteristics of Sample (N=250)		%
Age, M (SD)	45.91 (8.62)	
Number of children, M(SD)	1.68 (1.28)	
Average age of children M (SD)	16.98 (8.55)	
Gender		
	Male	95.8
	Female	4.2
Race		
	Caucasian	61.9
	African American	19.5
	Hispanic	16.1
	Asian	.4
	Other	2.1
Education		
	Some or no high-school	1.7
	High-School graduate	44.5
	Some college or training	31.9
	College graduate	13.9
	More than college	8.0
Marital Status		
	Married	78.2
	Separated or divorced	9.6
	Single	11.7
	Cohabiting	.4

Internal consistency

The reliability coefficient was very high, suggesting that the items are internally consistent (Cronbach's Alpha = .92, number of items = 26). Item-total analyses showed that removing any item from the scale made Cronbach's Alpha range between .916 - .926.

Discussion

Drawing from insights from the evolutionary psychology literature, this study proposed a high-K strategy fitness optimization model and assessed it with a scale tested on a sample of 250 US respondents. It was theorized that these indicators, making up the high-K independent criterion of fitness, will be associated with certain fitness outcomes. The results showed that the factors proposed in the model have significant effects on fitness as operationalized through perceived offspring quality and number of children. Moreover, the scale enjoyed excellent internal consistency and also showed good construct validity, correlating with number of medical diagnoses (negative), education (positive), social support (positive), and number of previous marriages (negative).

Although the results of this study are promising, some caveats are in order. First, the constraints of the data collection biased the sample to predominantly white males, which may raise 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, at different times, and in different contexts. Second, the scale was tested on an American sample, which may raise questions about cross-cultural generalizability. Although it can be argued that the sample tested is representative of the US population, or, in general, of the developed nations, in that it consisted of people integrated in the society with full-time regular jobs, it is nonetheless essential to examine whether these results can be replicated in other cultures. Third, the study constraints did not allow for a more sensitive coding of medical diagnoses. Indeed, while it can be argued that generally fewer number of different illnesses are indicators of increased adaptedness and stronger immune system, nevertheless, the severity of each illness should also be factored in (several relatively mild respiratory and digestive problems may present a much lower threat to survival and reproduction than one diagnosis of an aggressive malignant tumor).

Despite these caveats, however, the study presents an evolutionary theory-driven measure of the indicators that seem to make up the high-K independent criterion of fitness. It was shown, as expected, that this measure is strongly associated with perceived offspring quality, and weakly, but significantly, with number of children. The results of this study suggest that these indicators are relatively accurate, which translates into specific and significant effects on fitness.

Directions for further research

There are multiple directions for further research stemming from this study. One 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, importantly, number and quality of grandchildren. Longitudinal studies are required to address this latter relationship.

Another avenue of research would be examining the associations between this scale and objective measures of functioning, including measures of mental health. Indeed, testing whether a high-K strategy is associated with mental health, stress, or social and occupational disability, can have important theoretical implications and may have practical clinical implications.

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Appendix 1.

High-K Strategy Scale.

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1. The activities I engage in, both at work and elsewhere, are safe (not life threatening)
 2. I have good health benefits for my family and I
 3. I don't have major medical problems
 4. I am able to provide a decent quality of life for myself and my family
 5. I believe people think I am attractive
 6. I see my relatives (for example, parents, uncles/aunts, nephews/nieces, etc.) regularly
 7. My training and experience are likely to bring me opportunities for promotion and increased income in the future
 8. I live in a comfortable and secure home
 9. I live in a place where I can easily go outside and enjoy nature
 10. I am in good physical shape
 11. The neighborhood where I live is safe
 12. If I were to face a sudden threat (e.g., flood, fire), I believe I would have the ability to protect myself and my family
 13. If I wanted to, it would be easy for me to find and go on a new date
 14. If I had children and had to go away for a while, I could count on my relatives to take care of them
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15. If something bad happened to me, I'd have many friends ready to help me
16. The people I work with are like me
17. I live in a community to which I am well suited
18. My friends look up to me
19. If I had children and had to go away for a while, I could count on my friends to take care of them
20. I would be missed by people, besides my family, if I were to die
21. I meet with my friends regularly
22. My second-degree relatives (nephews, cousins, uncles, nieces) are generally healthy
23. Are you married or living with a partner?

If you are married or living with a partner answer the following

- a. I believe people find my spouse/partner attractive
 - b. My spouse/partner has not had major medical problems
 - c. If I were out of work, I could rely on my spouse/partner's income for a while without a significant drop in my quality of life
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