



Comparison of Life History Strategy measures



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ABSTRACT

Life History Strategy (LHS) describes a cluster of evolved traits whose adaptive function is to facilitate an organism's reproduction. Individuals who allocate more resources towards somatic and parental/nepotistic effort and less towards mating effort are described as slow life history strategists, while those with the opposite resource allocation pattern are described as fast life history strategists. There are many measures purported to measure individual differences in LHS, however these have not yet been systematically compared. In this paper we compare the Arizona Life History Battery (ALHB), Mini-K, High-K Strategy Scale, and two Super-K Factors and test the internal consistency or measurement model structure of each measure, and the convergent validity between the measures. We found all measures show adequate internal consistency and measurement model structure and in general, the ALHB, Mini-K, and one Super-K Factor show the strongest convergence between the measures. Implications are discussed.

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1. Introduction

Life History Strategy (LHS) is a construct developed within the biological sciences that describes a cluster of evolved traits whose adaptive function is to facilitate reproduction given inherent limits on how organisms can allocate their resources. There is variability in LHS both between and within species (Ellis, Figueredo, Brumbach, & Schlomer, 2009), including individual differences within humans as proposed by Rushton's (1985) Differential K Theory. Over the past decade, research on individual differences in human LHS has exploded and multiple ways to measure individual differences in LHS have been proposed. Dunkel and Decker (2010) recently presented a comparison of several measures of LHS, however many of the measures compared are considered by some to be only indicators of LHS (e.g., the General Factor of Personality is an indicator of a Super-K Factor in Figueredo et al., 2006), thus some of the measures compared represent only a domain-specific component of the more domain-general LHS construct, and do not represent the entire construct.

Many of newer measures present definitions of LHS that expand the original construct definition, thus expanding the nomological net surrounding LHS. Given this change, it is important to review and compare the various measures. Fig. 1 displays a sample of the hierarchy of constructs that constitute the "Super-K" Factor, which is the highest level of aggregation so far reported for LHS. The boxes

on the bottom are the individual scales that comprise the following manifest indicators: (1) the 7 subscales of the Arizona Life History Battery (Figueredo, 2007), enumerated below, measuring the K-Factor; (2) the Mental Functioning and Physical Functioning Factors comprising the Covitality Factor; and (3) the Big Five Factors comprising the General Factor of Personality, with Neuroticism reverse-scored to indicate Stability. This hierarchy is analogous (although not entirely homologous) to Carroll's (1993) three-stratum theory of cognitive abilities, measured at the narrow, broad, and general levels of aggregation.

To determine the convergent validity amongst these separate measures of LHS, we compare not only single self-report scales measuring LHS, but also higher-order latent constructs composed of many indicators of LHS. First, we present a review of life history theory, focusing on what the theory proposes are cognitive and behavioral indicators of individual differences in LHS. Next, we will describe some recently proposed cognitive/behavioral measures of LHS, including those based on a single measure and those based on multiple convergent measures. Finally, we will compare each of these measures on their internal consistency and measurement model structure and the extent to which the measures show convergent validity.

2. Life History Strategy

According to Life History Theory, we expect clusters of evolved traits to be selected to occur together and whose collective function is to lead to successful replication of one's genes

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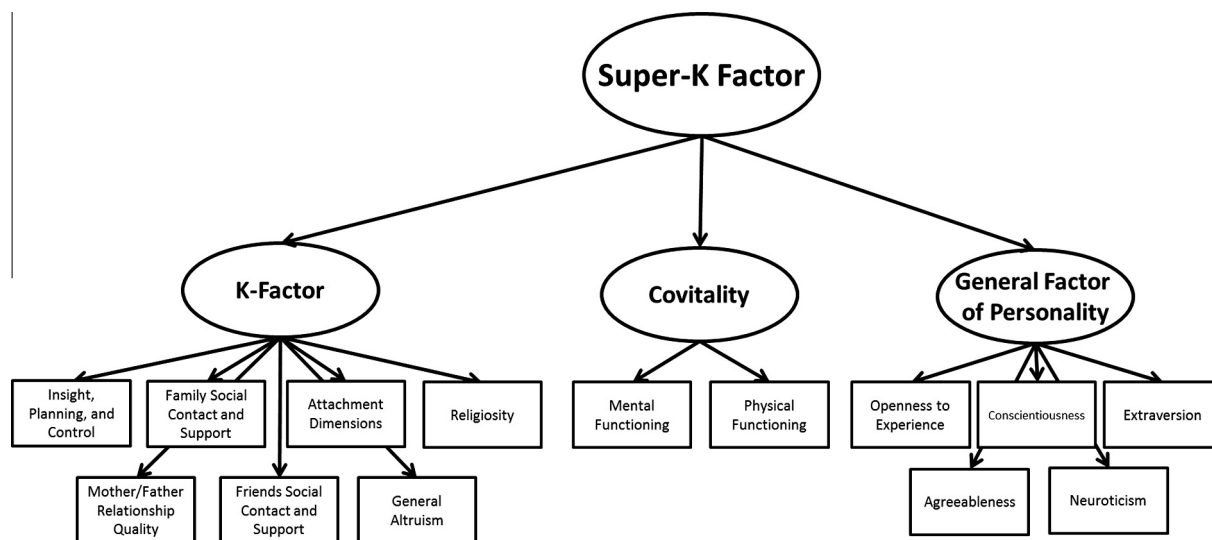


Fig. 1. Hierarchical model of LHS constructs.

within the particular ecological and social context that an individual develops (e.g., presence or absence of consistent investment, presence or absence of predators). One's LHS consists of optimally allocating one's time, energy, and material resources between two complementary components of fitness: (a) *somatic effort*, which is defined as effort directed maintaining one's own growth and survival; and (b) *reproductive effort*, which is defined as effort directed towards producing genetically related offspring that will serve as vehicles for one's genes. Reproductive effort is composed of two components: (a) *mating effort*, which is defined as effort directed towards attaining and retaining romantic/sexual partners; and (b) *parental/nepotistic effort*, which is defined as effort directed towards maintaining the survival of genetically related offspring, including one's own children or genetically related relatives (Figueredo et al., 2006).

Because *all* organisms (including humans) have limited bioenergetic (i.e., time, energy) and material resources, trade-offs must be made in how an organism allocates these resources to the components of fitness described above. The ratio of how time, energy, and resources are divided between those components is shaped both by environmental pressures faced by that organism's species over evolutionary time and by adaptive responses to the ecological and social context of one's own developmental time. For example, species that evolved in a dangerous and unpredictably changing environment are predicted to exhibit clusters of "fast" LHS traits. In those situations, since the environment is unlikely to support long-term investment in one's own survival or the survival of one's genetic relatives, it makes adaptive sense to develop to sexual maturity quickly, start producing offspring early in life, have more offspring, and exhibit decreased parental (and nepotistic) investment. This is because heavy investment in the survival of oneself, one's own offspring, or other genetic vehicles sharing some of your genes, is maladaptive if the prospects for long-term survival are relatively low. Thus, fast LHS individuals are expected to have offspring earlier, shorter interbirth intervals, more offspring, and high levels of extrinsic mortality. In other words, they are low on somatic effort, high on mating effort, and low on parental/nepotistic effort.

On the other hand, species that evolved in more predictable environments (where long-term survival is more reliable) should exhibit clusters of slow LHS traits. Because long-term survival was likely it was evolutionarily adaptive for them to invest heavily in their own survival, have few offspring that were genetically well

sued for their particular environment, and provide extensive parental and nepotistic care. Hence, these individuals should be high on somatic effort, low on mating effort, and high on parental/nepotistic effort (Figueredo et al., 2006).

There is variability in LHS traits both between and within species (Ellis et al., 2009). Humans, although generally characterized by slow life history strategies, vary in the extent to which they display slow LHS characteristics and behaviors and range on a slower to faster LHS continuum. Individuals with a slower LHS are hypothesized to demonstrate higher investment and commitment in many aspects of their life, including their romantic relationships. These individuals should be highly selective in their mate choice, provide extensive parental investment, make long-term plans, and have long-term relationships. These individuals are more likely to be monogamous, altruistic, cautious risk-takers, adherent to social rules, cooperative, and give and receive more social support to and from kin and non-kin. In comparison, those with a faster LHS are hypothesized to have many sexual partners in their lifetime, provide lower parental investment, plan only for the short-term, and have short-term relationships. These individuals should be impulsive, promiscuous, demonstrate less altruism, less cooperation, give and receive less social support, have higher disregard for social rules, and engage in more extensive risk-taking (Figueredo et al., 2005).

3. Cognitive and behavioral indicators of LHS

The following measures propose to measure individual differences in the human LHS.

3.1. Arizona Life History Battery (ALHB)

The ALHB is the largest and seemingly most comprehensive measure of LHS. This measure was developed by Figueredo (2007), with a Spanish version by Figueredo and Gaxiola (2007), and assesses a variety of behavioral and cognitive indicators of LHS by adapting existing scales or developing new scales. The ALHB includes eight scales, some of which have subscales: (1) Mini-K Short Form, a stand-alone short-form measure of LHS (described in the next section; Figueredo et al., 2006); (2) Insight, Planning, and Control (adapted from Brim et al., 2000); (3) Mother/Father Relationship Quality, with subscales to separately

assess Mother Relationship Quality and Father Relationship Quality (adapted from [Brim et al., 2000](#)); (4) Family Social Contact and Support, with subscales to separately assess Family Social Contact and Family Social Support (adapted from [Barrera, Sandler, & Ramsay, 1981](#)); (5) Friends Social Contact and Support, with subscales to separately assess Friends Social Contact and Friends Social Support (adapted from [Barrera et al., 1981](#)); (6) Experiences in Close Relationships, which measures anxious, avoidant, and secure attachment dimensions ([Brennan, Clark, & Shaver, 1998](#)); (7) General Altruism, with subscales for Altruism towards Own Children, Altruism towards Kin, Altruism towards Friends, and Altruism towards Community (adapted from [Brim et al., 2000](#)); and (8) Religiosity (adapted from [Brim et al., 2000](#)).

3.2. Mini-K

The Mini-K ([Figueredo et al., 2006](#)) is a 20-item short-form version of the ALHB with two to three items assessing each construct measured in the ALHB (also available in Spanish; [Figueredo & Gaxiola, 2007](#)). While based on the ALHB, there are no individual items repeated. The individual items within the other ALHB subscales represent more detailed facets of the specific construct measured by each subscale. The more global items developed for the Mini-K were designed to measure the overall content of each other ALHB subscale. This measure has around a .70 internal consistency, as assessed by Cronbach's Alpha, and around a .70 test-retest reliability. A recent meta-analytic construct validation study of 7078 English-speaking North American undergraduate college students across 34 studies supports the construct validity of this measure ([Figueredo et al., under review](#)).

3.3. High-K Strategy Scale

The High K Strategy Scale ([Giosan, 2006](#)) measures slow (i.e., "High K") LHS. Previous research has reported its internal consistency to be around 0.90 (e.g., [Gladden, Welch, Figueredo, & Jacobs, 2009](#)). Its items assess a wide variety of characteristics that are theoretically related to slow LHS such as good health (e.g., "I am in good physical shape"), safety/stability of environment (e.g., "The activities I engage in, both at work and elsewhere, are safe (not life threatening)"), and positive self-view/perceived social success ("My friends look up to me").

3.4. Super-K Factors

Some researchers have developed their own Super-K Factors, which are proposed as higher-order factors representing individual differences in LHS. These Super-K Factors present expanded multi-operational definitions of earlier LHS definitions. [Figueredo et al. \(2006\)](#) developed a Super-K Factor, comprised of the K-Factor, assessed by the ALHB, the Covitality Factor, composed of scales measuring subjective well-being, positive and negative affect, general health, and medical symptoms, and the General Personality Factor, composed of the Big-Five Personality Factors.

[Olderbak and Figueredo \(2010\)](#) created a Super-K Factor composed of a short-form measure of LHS (Mini-K; [Figueredo et al., 2006](#)), a measure of Mate Value (Mate Value Inventory; [Kirsner, Figueredo, & Jacobs, 2003](#)), and the General Factor of Personality, which was a composite measure of standardized scores from Conscientiousness, Agreeableness, Extraversion, and reverse scored Neuroticism (measured with the NEO Five Factor Inventory; [Costa & McCrae, 1992](#); see [Figueredo & Rushton, 2009](#), for a theoretical justification for the inclusion of this construct as an indicator of LHS). This factor structure was conceptually very similar to the Super-K Factor structure proposed in [Figueredo et al. \(2006\)](#). Because [Olderbak and Figueredo \(2010\)](#) were interested in the shared

trait levels of a romantic couple predicting the relationship satisfaction of a single partner in that couple, the trait levels of both romantic partners in the couple were averaged together; thus the three indicators of LHS were averages across both partners' scores. Their Super-K Factor was labeled Life History Strategy Mean, because it represented the overall LHS score for the couple on average, and was modeled with confirmatory factor analysis. When predicting change in relationship satisfaction over time, the Super-K Factor demonstrated adequate fit to the data.

[Olderbak and Figueredo \(2012\)](#) expanded their original model of LHS in a second paper. In addition to the three indicators used in [Olderbak and Figueredo \(2010\)](#), the new model included the couple's shared Mating Effort (measured by the Mating Effort Scale; [Rowe, Vazsonyi, & Figueredo, 1997](#)), shared Self-Monitoring (measured by the Self Monitoring scale; [Snyder, 1974](#)), and shared Intentions Towards Infidelity (measured by the Intentions Towards Infidelity scale; [Jones, Olderbak, & Figueredo, 2011](#)). As in [Olderbak and Figueredo \(2010\)](#), the Super-K Factor was modeled with confirmatory factor analysis. In this model, the first three indicators first loaded on a latent variable called Convergent Interests Mean, the second three indicators loaded on a latent variable called Divergent Interest Mean, and then Convergent Interest Mean and Divergent Interest Mean loaded on a single higher-order factor labeled Life History Strategy Mean. Overall, when predicting the relationship satisfaction of a single partner, the model showed adequate fit to the data.

4. Research questions

- (1) Do the cognitive/behavioral LHS measures show adequate internal consistency and measurement model structure?
- (2) What is the convergent validity between the cognitive/behavioral measures of LHS?
- (3) To what extent do the subscales of multi-scale measures of LHS (i.e., ALHB, Super-K Factors 1 and 2) relate to the single scale measures of LHS (i.e., Mini-K, High K Strategy Scale)?

5. Methodology

5.1. Sample

This sample consisted of 227 participants recruited from the Psychology testing pool at the University of Arizona. The participants were primarily female (61%), White non-Hispanic (71%), and average age was 18.98 years ($SD = 1.15$). Participants were compensated with experimental credit for participating.

5.2. Measures and procedure

Participants completed several questionnaires online (www.eepresearch.org) in a place of their choosing; average testing duration was about 2 h. Access to the website where they completed the questionnaires was password protected rather than open access. Because several questionnaires were administered, we will only present those discussed in this paper. Internal consistency, or fit of the measurement model structure to the data, will be presented in the Results section.

5.2.1. Arizona Life History Strategy Battery (ALHB; [Figueredo, 2007](#))

As mentioned above, this measure is composed of several scales, some of which are composed of individual subscales. Each scale, with the exception of the Family and Friends Contact and Support scales, uses a 7-point Likert scale indicating the extent to which participants agree or disagree with each item. The Family and Friends Contact and Support scales use a 0 to 3 scale indicating

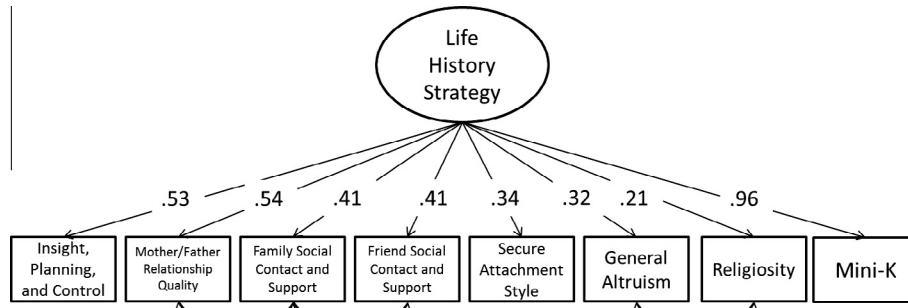


Fig. 2. Measurement model of the ALHB. All paths are statistically significant.

how often each item occurs. The full ALHB is available at <http://www.u.arizona.edu/~ajf/pdf/Arizona%20K-Battery.pdf>.

5.2.2. LHS short form (Mini-K; Figueredo et al., 2006)

This questionnaire is composed of 20-items and uses a 7-point Likert scale which participants use to indicate the extent to which they agree or disagree with each item.

5.2.3. High K Strategy Scale (HKSS; Giosan, 2006)

This questionnaire is composed of 23-items (with 3 additional items for married participants) with a 5-point Likert scale which participants use to indicate the extent to which they agree or disagree with each item.

5.2.4. Super-K Factor 1

This factor was developed by Olderbak and Figueredo (2010) and includes three scales: (1) Mini-K (Figueredo et al., 2006); (2) General Factor of Personality as assessed by the NEO-FFI (Costa & McCrae, 1992); and (3) Mate Value Inventory (MVI; Kirsner et al., 2003).

5.2.5. Super-K Factor 2

This factor was developed by Olderbak and Figueredo (2009) and includes: (1) Mini-K (Figueredo et al., 2006); (2) General Factor of Personality as assessed by the NEO-FFI (Costa & McCrae, 1992); (3) Mate Value Inventory (MVI; Kirsner et al., 2003); (4) Mating Effort Scale (Rowe et al., 1997); (5) Intentions Towards Infidelity Scale (Jones et al., 2011); and (6) the Self-Monitoring Scale (Snyder, 1974). The last three measures were negatively related to the general construct so these scales were reverse-coded.

6. Results

6.1. Research question 1: internal consistency and measurement models

When assessed with Cronbach's Alpha, the internal consistency of both the Mini-K ($\alpha = .74$) and the High-K Strategy Scale ($\alpha = .86$) are adequate. Because the ALHB and Super-K Factors 1 and 2 are based on several measures, these measures are best modeled as measurement models in confirmatory factor analysis.

A measurement model of the ALHB, with a single higher-order factor predicting each of the ALHB subscales, was modeled (see Fig. 2). After allowing three covariances between subscales, specifically Mother/Father Relationship Quality with Family Social Contact and Support, Family Social Contact and Support with Friend Social Contact and Support, and General Altruism with Religiosity, the model showed adequate fit to the data ($\chi^2_{(17, n=222)} = 37.53, p < .01; RMSEA = .074_{(.042-.011)}; CFI = .93; NFI = .89; NNFI = .89$).

Next, both Olderbak and Figueredo (2010, 2012) Super-K Factors were modeled. These models are necessarily different from the original models because we only have data from a single participant, whereas both of the original models were based on within-couple averaged trait scores. Because there are only three manifest indicators of the higher-order LHS factor in Olderbak and Figueredo (2010), this model will necessarily produce a perfect fit to the data. We still included the model here to illustrate that the path loadings indicate the indicators are strongly related to the LHS factor (see first model in Fig. 3).

Next, the Olderbak and Figueredo (2012) Super-K factor was modeled. We found the model fit better without first structuring the subscales through the Convergent and Divergent Indicator latent variables. Instead, all variables were modeled to

Olderbak & Figueredo (2010) Super-K Factor Olderbak & Figueredo (2012) Super-K Factor

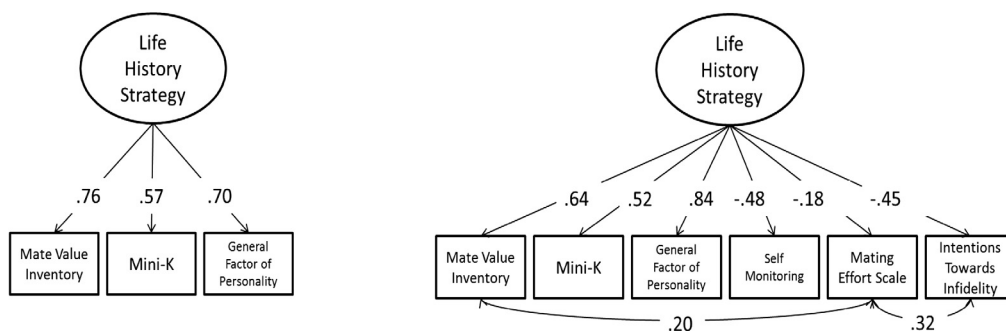


Fig. 3. Measurement model of the Olderbak and Figueredo (2010, 2012) Super-K Factors. All paths are statistically significant.

Table 1
Correlations and shared variance between measures of LHS.

	ALHB	Mini-K	HKSS	Super-K Factor 1	Super-K Factor 2
Mean	.00	1.41	1.65	−.01	.00
Standard deviation	.56	.59	.66	.81	.62
ALHB		.64	.29	.58	.37
Mini-K	.80*		.25	.60	.40
HKSS	.55*	.50*		.44	.28
Super-K Factor 1	.76*	.77*	.66*		.70
Super-K Factor 2	.61*	.63*	.53*	.84*	

Note: Values above the diagonal are R-squareds indicating shared variance and value below the diagonal are Pearson Product Moment correlation coefficients.

* $p < .05$.

Table 2
Correlations between the ALHB components and measures of LHS.

ALHB scales	Subscales	Cronbach's alpha	ALHB composite	Mini-K	HKSS	Super-K Factor 1	Super-K Factor 2
Mini-K	Full scale	.74	.80*	1.00*	.50*	.77*	.63*
Insight, planning and control	Full scale	.87	.65*	.51*	.40*	.61*	.46*
Mother/Father Relationship Quality	Full scale	.94	.59*	.52*	.31*	.42*	.34*
	Mother relationship quality	.89	.59*	.53*	.32*	.46*	.40*
	Father relationship quality	.94	.44*	.36*	.19*	.17*	.08*
Family contact and support	Full scale	.91	.57*	.39*	.25*	.31*	.27*
	Family contact	.87	.51*	.41*	.29*	.37*	.35*
	Family support	.91	.51*	.32*	.19*	.23*	.18*
Friends contact and support	Full scale	.87	.55*	.38*	.36*	.36*	.26*
	Friends contact	.87	.49*	.32*	.29*	.27*	.18*
	Friends support	.86	.41*	.31*	.35*	.38*	.31*
Secure attachment style	Full scale	.93	.41*	.33*	.31*	.47*	.52*
General Altruism*	Full scale	.90	.55*	.29*	.25*	.39*	.27*
	Altruism towards own kin	.84	.39*	.20*	.30*	.24*	.17*
	Altruism towards friends	.86	.37*	.20*	.44*	.38*	.29*
	Altruism towards community	.89	.52*	.30*	.20*	.37*	.26*
Religiosity	Full scale	.97	.39*	.20*	.10*	.14*	.01*

Note: *Because we surveyed college students, most of our participants do not have children. As such, as recommended by Figuredo (2007) the Altruism Towards Own Children subscale was not included in the General Altruism scale.

* $p < .05$.

load on a single higher-order factor, and mating effort was allowed to covary with mate value and with intentions towards infidelity (see second model in Fig. 3). The model showed adequate fit to the data ($\chi^2_{(7, n=218)} = 15.62, p < .05; RMSEA = .075_{(.023-.013)}; CFI = .97; NFI = .94; NNFI = .93$), however the Mating Effort Scale was weakly related to the higher-order LHS construct, and required two covariances with other scales in the model. This suggests the mating effort scale does not sufficiently contribute to the general LHS factor, and is unnecessary in future models.

6.2. Research question 2: relations between LHS measures

In order to compare the single-scale measures of LHS with the multi-scale measures, the scales within the multi-scale measures were first z-score transformed and then averaged to create a single score. Because the multi-scale measures were standardized, the sample-level average of the final composite scores are necessarily around zero.

As is indicated by Table 1, all scales are strongly correlated with one another, however when shared variance is computed, one sees that some of the scales share substantially less variance compared to what one would expect. The highest shared variance in LHS measures is between both Super-K Factors, however this is because both measures share three scales. The Mini-K with its longer form, the ALHB, and the Super-K Factor 1 show the highest convergent validity. The HKSS shares less than 30% variance with the Mini-K or ALHB.

6.3. Research question 3: relations with components of LHS measures

The Mini-K, HKSS, Super-K Factor 1, and Super-K Factor 2 are significantly correlated with the first seven components of the ALHB, but only the Mini-K and Super-K Factor 1 are significantly correlated with the last component, Religiosity (see Table 2). While the subscales of the ALHB scales relate about the same as the full scale to the ALHB composite variable, these subscales relate differentially to the other non-ALHB measures. Father Relationship Quality is particularly interesting, as it relates significantly to the Mini-K and HKSS, but is unrelated to either Super-K Factors. These findings again support that the ALHB, Mini-K, and Super-K Factor 1 are the most interrelated LHS scales.

ALHB, Mini-K, and the HKSS are moderately to strongly related to the Mate Value Inventory and General Factor of Personality components of the Super-K Factor 1 and 2 (see Table 3). The Super-K Factor 1, ALHB, Mini-K, and HKSS are weakly to moderately related to the Intentions Towards Infidelity and Self-Monitoring components of the Super-K Factor 2, and unrelated to the Mating Effort Scale. The weak or non-relations with the three unique components of the Super-K Factor 2 highlight why the Super-K Factor 2 is less related as an overall construct with the other LHS measures, compared to the Super-K Factor 1.

7. Discussion

The above results suggest that the Mini-K, ALHB, and Super-K Factor 1 are the most convergent measures of LHS. These results

Table 3
Correlations between measures of LHS with the components of both Super-K Factors.

Super-K Subscales		Subscale Components	Cronbach's Alpha	Super-K Factor 1	Super-K Factor 2	ALHB	Mini-K	HKSS	
Super-K Factor 1	Super-K Factor 2	Mini-K	Full Scale	.74	.77*	.63*	.80*	1.00*	.50*
		Mate Value Inventory	Full Scale	.81	.82*	.62*	.57*	.43*	.58*
			Full Scale	NA	.81*	.78*	.47*	.40*	.52*
		General Factor of Personality	Conscientiousness	.80	.57*	.53*	.35*	.32*	.32*
			Extraversion	.76	.60*	.49*	.45*	.34*	.53*
			Agreeableness	.76	.51*	.66*	.24*	.31*	.36*
	Neuroticism (reversed)		.74	.52*	.46*	.26*	.16*	.24*	
	Mating Effort Scale – Reversed	Full Scale	.75	.07	.44*	.05	.12	-.07	
	Intentions Towards Infidelity – Reversed	Full Scale	.78	.37*	.68*	.20*	.27*	.17*	
	Self-Monitoring - Reversed	Full Scale	.40	.31*	.57*	.18*	.14*	.30*	

Note: * $p < .05$; NA = Not applicable

indicate that while all of the proposed measures of LHS that were tested show adequate internal consistency, the Mini-K, ALHB, and Super-K Factor 1 show the most convergence. Of those measures, the decision of which is best to use may be more about practicality. The Mini-K, at only 20-items, is drastically shorter than the other measures, with the ALHB the longest.

In addition to what was measured in this sample, there are other Super-K Factors, such as the original Super-K Factor proposed in Figueredo et al. (2006) and the Protective Life History factor proposed in Gladden, Sisco, and Figueredo (2008). Unfortunately, the measures indicating these Super-K latent factors were not included in this study and hence could not be tested. Future research should examine the convergent validity of these Super-K Factors as well.

The measures examined in this paper can be considered *psychometric* measures of LHS; these measures asked about cognitive and behavioral indicators of LHS and are the dominant measurement type used in the field. However, there are other less commonly applied approaches to measuring individual differences in LHS, such as measuring the actual reproductive history of the participant and their family members. From this information, one could identify specific LHS parameters (e.g., mother's age at first birth) and build composite variables indicating that individual's LHS. Similar work has been presented. For example, LHS has compared with behavior in the laboratory and in real life situations (see Sherman, Figueredo, & Funder, in press) and to number of places visited in a day (Wolf, Figueredo, & Jacobs, 2013). In addition, this group is beginning to investigate the relation between psychometric measures of LHS and behavioral indicators of LHS including sleep patterns, heart rate activity while stressed, social networks, chat room behavior, and family structure. Future research should continue to investigate the psychometric properties of these other approaches and compare them with the psychometric measures discussed in this paper.

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