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Regular Article

Attachment security, environmental adversity, and fast life history behavioral profiles in human adolescents

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Abstract

One species-general life history (LH) principle posits that challenging childhood environments are coupled with a fast or faster LH strategy and associated behaviors, while secure and stable childhood environments foster behaviors conducive to a slow or slower LH strategy. This coupling between environments and LH strategies is based on the assumption that individuals' internal traits and states are independent of their external surroundings. In reality, individuals respond to external environmental conditions in alignment with their intrinsic vitality, encompassing both physical and mental states. The present study investigated attachment as an internal mental state, examining its role in mediating and moderating the association between external environmental adversity and fast LH strategies. A sample of 1169 adolescents (51% girls) from 9 countries was tracked over 10 years, starting from age 8. The results confirm both mediation and moderation and, for moderation, secure attachment nullified and insecure attachment maintained the environment-LH coupling. These findings suggest that attachment could act as an internal regulator, disrupting the contingent coupling between environmental adversity and a faster pace of life, consequently decelerating human LH.

Keywords: caregiver–child attachment; extrinsic and intrinsic mortality risks; fast and slow life history behavioral profiles

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Introduction

Life history (LH) theory posits that adverse childhood environments marked by high and variable threats of death and disability, stemming from external factors like predation, accidents, violence, and infectious diseases, are associated with a fast or faster LH strategy (Ellis et al., 2009). This strategy prioritizes mating and reproduction over efforts to mitigate mortality and improve the living environment. Conversely, safe and stable childhood living environments lead to a slow or slower LH strategy and related behaviors (e.g., disease control effort; Chang et al., 2021) that aim at reducing and improving the external mortality conditions at the expense of delayed reproduction. Using different terminologies, Belsky et al. (1991) first identified this environment-LH contingency with human development (Also see Belsky, 2012, 2019). However, alternative perspectives, such as internal LH models (Nettle and Bateson, 2015; Nettle et al., 2013), propose that an individual's internal body state may play a role in shaping LH strategies or regulating the impact of the external environment on LH. Notably absent in existing internal models is the consideration of caregiver–child attachment – a crucial internal system evolved specifically to address extrinsic mortality threats (e.g., predation; Bowlby, 1969). The current study seeks to explore caregiver–child attachment as an internal mental state in the calibration and modulation of LH strategies. Similar to other internal models where early environments influence individuals' internal somatic state, determining LH, in our internal mental state model, attachment is hypothesized to mediate and moderate the effects of external environmental factors on LH strategies.

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Intrinsic somatic models of LH

LH theory distinguishes between intrinsic and extrinsic components of morbidity and mortality (Williams, 1957). The intrinsic component refers to functional degradation stemming from decay of an individual's internal system (physiological and psychological functions). Aging-related wear and tear of the body and mind, degenerative diseases (e.g., heart and kidney problems), and unhealthy habits (e.g., smoking) exemplify intrinsic mortality risks (Carnes et al., 2006). Extrinsic morbidity and mortality refer to disability and death that befall an individual due to external and mostly uncontrollable factors such as predation, accidents, and infectious diseases. These two components of morbidity and mortality interact in bringing about an individual's eventual demise (Carnes et al., 2006), and the internal state and the external environment together determine LH strategies (e.g., Nettle and Bateson, 2015; Nettle et al., 2013). Research on human and nonhuman animals has documented the interplay between intrinsic and extrinsic conditions. For example, trematoda parasite (external environment) causes deadly diseases (internal state) that make marine snails mature faster (faster LH, Lafferty, 1993), whereas great tits unaffected by parasite infestation engage in disease control effort and delay reproduction (slower LH, Oppliger et al., 1994). In humans, extrinsic adversities (e.g., socioeconomic deprivation) compromise the intrinsic somatic state (e.g., chronic illness and poor health) that calibrates faster LH such as an early age of pregnancy (Waynforth, 2012), early onset of menarche, tendency to engage in risky conduct (Hartman et al., 2017), and reckless sexual and aggressive behavior (Chang et al., 2019a; Ellis et al., 2021).

Attachment as an internal mental regulator of LH

In these models, the intrinsic body state mediates extrinsic mortality conditions and calibrates LH either by initiating mortality-reduction strategies (e.g., disease control efforts) and slowing other aspects of life such as reproduction, or by accelerating reproduction and disregarding mortality threats. The resulting predicted adaptive LH tailors to the vitality status of the internal body state (Nettle et al., 2013) and represents adaptive strategies in managing mortality threats of the external environment (Clutton-Brock, 1984). Extending these internal somatic models of LH calibration, we conceptualize the attachment system as a possible internal mental state in organizing and modulating LH. Similar to how physical state is involved in registering the external environment, the mental state of attachment mediates and regulates the maternally socialized environment and formulates LH (Chisholm, 1996). Mammalian species first experience the external environment through interactions with their mothers or other primary caregivers (Bornstein, 2019). Through innumerable caregiver–child interactions, the individual develops an internal working model as an internalized appraisal of the environment and of the self (Bowlby, 1969) that subsequently guides, organizes, and automates behavior (Zimmermann, 1999). Evolved to protect from predation (Bowlby, 1969), attachment and the internal working model are especially involved in processing extrinsic mortality information (Chisholm, 1996) and the individual's ability to cope with mortality threats (Lu et al., 2022). "Henceforward, the two working models each individual must have are referred to respectively as his environmental model and his organismic model" (Bowlby, 1969, p. 82). Other early writings similarly refer to attachment and the internal working model as "an organism's capacity to interact effectively with its environment" (White, 1959, p. 297), "the infant's belief that its actions affect his environment" (Lewis & Goldberg, 1969, p. 82), "broadly conceived competence" (Arend et al., 1979, p. 951), and "the ability to negotiate with the environment" (Cassidy, 1986, p. 331). Similar to other internal LH models, attachment and the internal working model represent the internal mental state (vis-à-vis the physical state) that provides cognitive and perceptual information (vis-à-vis sensory and interoceptual information) concerning an individual's cognitive (rather than physical) status. Accordingly, attachment and its internal working model calibrate LH strategies by attempting to reduce and outlive (slow LH) or disregard and outgrow (fast LH) extrinsic mortality risks.

Once formed, attachment operates outside consciousness (Chisholm, 1996; Main, 1991). We propose two mechanisms to account for this operation. In one, attachment acts as an intermediary that conveys external information and engenders the species-general contingency between adverse environments and fast LH (Belsky et al., 1991; Chisholm, 1996; Del Giudice & Belsky, 2011). In the other, attachment as an internal mental regulator has the additional effect of breaking away from the external contingency and generates new pathways primarily in the slow LH direction of mortality reduction (Lu et al., 2021). In the first mediation process, a child inherits the same extrinsic mortality conditions from his/her caregiver and is rendered the same effects through caregiving behavior and the caregiver's other LH manifestations. According to the pioneering work by Belsky et al. (1991) and other LH researchers (e.g., Chisholm, 1996; Del Giudice & Belsky, 2011; Simpson & Belsky, 2008), the actual environment and caregiver-mediated childhood experience should yield similar effects on LH calibration. Hence, attachment should (statistically) mediate the species-general coupling between the environment and LH. We postulate that a stable living environment is aligned with consistent caregiving, secure attachment, an internal working model that regards the world as predictable and the self as efficacious, and slow LH calibrations (Chisholm, 1993, 1996; Simpson & Belsky, 2008) aimed at mortality reduction. A secure internal working model inscribes the mortality-reduction mindset of slow LH that manifests through insight, planning, and control (Figuredo et al., 2018; Thompson, 2021). By contrast, fast LH strategies and a mortality-carefree mindset are associated with environmental harshness and unpredictability, neglectful and inconsistent caregiving, and an insecure internal working model rendering the individuals doubtful of their abilities and fearful and skeptical of the world (Belsky et al., 2010; Chen & Chang, 2012).

In the second regulatory (statistical moderation) process, the attachment system has the additional effect of buffering or underregistering rather than overregistering or amplifying environmental risks, and of undercalibrating rather than overcalibrating environmental adversities into fast LH strategies (Sung et al., 2016). The overall net effect of the attachment system is expected to attenuate the coupling between extrinsic mortality risks and fast LH strategies (Lu et al., 2022). Specifically, secure attachment should downregulate, and insecure attachment should maintain, the coupling between extrinsic mortality and fast LH. Therefore, the attachment system may direct children toward two separate developmental pathways. One is a slowing LH pathway wherein species-general coupling between extrinsic mortality and fast LH is downregulated by secure attachment and the related mortality-reduction effort. The other is a species-general LH pathway perpetuated by insecure attachment of individuals who continue to be shaped by environmental adversities into mortality-carefree fast LH strategists.

Our theorizing (statistical mediation and moderation) about attachment is supported by the empirical literature, which has mainly examined retrospective measures of the childhood environment in relation to concurrent measures of adolescent and adult attachment. For example, a retrospective questionnaire measure of early environmental predictability was positively correlated with secure adult attachment, which itself was positively correlated with long-term (rather than short-term) intimate relationships (Hill et al., 1994). Another retrospective study yielded similar findings that childhood environmental unpredictability was positively correlated with insecure adult attachment, and the latter was positively correlated with intimate partner violence consisting of psychological aggression, physical assault, and sexual coercion (Barbaro & Shackelford, 2019). The same mediating effect was also reported in additional studies of relations between childhood adversity and fast LH profiles such as psychological distress, harmful drinking, and criminal thinking (Corcoran & McNulty, 2018; Le et al., 2018; Yang & Perkins, 2020). To a lesser extent, studies also show that attachment measures statistically moderate the relation between environmental adversity (family income-to-needs ratio, parental stress, maternal depression) and fast LH manifestations (early onset of menarche, aggressive behavioral problems, internalizing behavior; Sung et al., 2016; Tharner et al., 2012; Whittenburg et al., 2022).

Present study

Here we tested the statistical mediating and moderating hypotheses about attachment in relation to environmental adversity and fast LH behavioral profiles (Figure 1) in a longitudinal and cross-cultural sample consisting of 1,169 adolescents and their primary caregivers from nine countries. Information about childhood environmental adversity, which was indicated by three proxies, namely unsafe neighborhoods, chaos in the home, and unpredictable life events, was obtained from the adolescents and one parent when the adolescents were 10 years old on average. However, data collection began when the children were 8 years old, and family environments remained stable throughout the subsequent data collection phases. Secure attachment was measured based on the adolescents' self-reports and reports from both parents when the adolescents were on average 14 years old. Fast LH behavioral profiles consisting of aggression, impulsivity, and risk taking were obtained from adolescents when they were 17 years old. Structural equation modeling was conducted to test relations among these variables with a focus on attachment as both a mediator and a moderator. Attachment was hypothesized to mediate the species-general coupling between environmental adversity and fast LH behavioral profiles. In testing the statistical moderation of attachment, we expected an attenuated association between environmental adversity and fast LH behavioral profiles for higher levels of secure attachment and we expected the strength of the association to be unchanged at lower levels of secure attachment.

Method

Participants

Data for the present study were drawn from an ongoing longitudinal study that originally recruited children, their mothers, and their fathers in 2008 when the children were 8 years old on average. Families were sampled from 10 cities in nine countries: Shanghai, China ($n = 101$), Medellín, Colombia ($n = 100$), Naples, Italy ($n = 95$), Rome, Italy ($n = 99$), Zarqa, Jordan ($n = 112$), Kisumu, Kenya ($n = 95$), Manila, Philippines ($n = 100$), Trollhättan/Vänersborg, Sweden ($n = 95$), Chiang Mai, Thailand ($n = 100$), and Durham, North Carolina, United States ($n = 101$ European Americans, $n = 94$ African Americans, $n = 77$ Latin Americans). Participants were recruited from schools and communities. Most parents lived together (82%), and were biological parents (97%); nonresidential and non-biological parents also provided data. Sampling included families from each country's majority ethnic group, except in the United States, where we sampled equal proportions of White, Black, and Latino families. Families from different socioeconomic backgrounds were sampled in proportions representative of each recruitment area. The present sample consisted of 1,169 adolescents (51% girls), their mothers ($n = 1,150$), and their fathers ($n = 1,048$). In the last data collection wave of the present study, Time 3, the adolescents were 17 years of age on average ($M = 17.27$ years, $SD = .63$). They were 10 ($M = 10.29$ years, $SD = .65$) at Time 1 and 14 years old on average ($M = 14.28$ years, $SD = .63$) at Time 2 of the present study. At Time 3 of the present study, 78% of the initial sample at Time 1 were with the study eight years later. Participants who provided complete data across the eight years did not differ from the initial sample with respect to adolescent gender, parent marital status, education, and all the substantive variables used in the study. Adolescent age and gender did not vary across sites.

Interview procedures

The primary data collection method for the present study was face-to-face interviews. Interviews lasted 1.5 to 2 hours at each of the three times of data collection and were conducted in participating adolescents' homes, schools, or at other locations chosen by the participants. Interviews and procedures were approved by the XX University Institutional Review Board (IRB, protocol number 2032) and by the local IRBs at universities in each participating country. Mothers and fathers provided written informed consent, and adolescents provided assent. Family members were interviewed separately to ensure privacy. Measures used in the interviews were administered in the official language of each country, following forward- and back-translation of all instruments. For the present study, adult participants were given the choice of completing the measures in writing or orally, with the interviewer reading the questions aloud and recording the participants' responses (with a visual aid to ensure that participants understood the response scales). At Time 1, the adolescents, then children, were administered the measures orally, and for the two subsequent assessments they were given the option of completing the measures orally or in writing. Parents completed the questionnaire measures in writing. To thank them for their participation, adolescents were given small gifts or monetary compensation, parents were given modest financial compensation, families were entered into drawings for prizes, and modest financial contributions were made to adolescents' schools.

Measures

Environmental adversity measured at time 1 when adolescents were 10 years old

In the empirical human LH literature, levels (harshness) and variations (unpredictability) of extrinsic morbidity and mortality are measured by sampling proxies from the current living environment that are believed to cue adverse environmental conditions of the ancestral past (Young et al., 2020). Environmental harshness and unpredictability are both predictive

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of LH in the same direction (Lu et al., 2022), but cues of unpredictability appear to be stronger predictors than cues of harshness (Hartman et al., 2018). Thus, we sampled more unpredictability cues and combined the two kinds of cues to form a single construct of environmental adversity. Three indicators, unsafe neighborhood, chaos in the home, and unpredictable life events, form the environmental adversity construct.

Unsafe neighborhoods. Mothers and children separately reported on the 7-item questionnaire measuring the perceived safety and livability of a neighborhood (Murray & Greenberg, 2006; e.g., "My neighborhood is a dangerous place to live," "My neighborhood is a nice place to live" (reverse coded), and "I feel scared in my neighborhood"). Using a 4-point scale ranging from 0 = "almost never true" to 3 = "almost always true," the items were measured or recoded in the direction of unsafe neighborhood. Internal consistency reliability estimates were .86 for mother reporting and .77 for child reporting. The correlation between the two ratings was .42. For the structural equation modeling and other analysis reported later, the average of the two ratings was used as an indicator of environmental adversity.

Chaos in the home. We adopted 5 items from the Confusion, Hubbub, and Order Scale (Matheny et al., 1995) to measure confusion, chaos, and disorder in the home (e.g., "It's a real zoo in our home," "The atmosphere in our home is calm" (reverse coded), and "You can't hear yourself think in our home"). Mothers and children responded to these questions on a 5-point scale ranging from 1 = "definitely untrue" to 5 = "definitely true." Internal consistency reliability estimates were .67 for mothers and .61 for children. The correlation between the two ratings was .34. In subsequent analyses, the average of the two ratings formed an indicator of environmental adversity.

Unpredictable life events. Using the Social Readjustment Rating Scale (Holmes & Rahe, 1967), mothers reported on whether 10 unpredictable negative life events happened in the last 2 years in the family to which the child was likely to be exposed (e.g., "severe and/or frequent illness," "accidents and/or injuries," and "death of other important person"). The 10 items were summed to create a scale. Internal consistency reliability estimate was .65.

Secure attachment measured at time 2 when adolescents were 14 years old

Ratings from both parents and from the children provided three indicators of secure attachment.

Parent ratings. We employed a single-item measure of secure attachment, similar to the widely used measure of adolescent and adult romantic attachment by Hazan and Shaver (1987). Hazan and Shaver (1987) adapted Ainsworth et al.'s (1978) verbal description of secure attachment to better suit the adult population. In our study, we utilized Ainsworth et al.'s (1978) original description, separately asking both parents to rate, on a 7-point scale ranging from "1 = not at all fit (0%)" to "7 = complete fit (100%)," the extent to which their child fits the description of secure attachment.

Child rating. The Security Scale (Kerns et al., 1996, 2000) originally has 15 but also uses 8 self-report items (Kerns et al., 2005; Pauletti et al., 2016). It adopts Harter's format to measure children's perceptions of a secure attachment relationship with a parent. We used 8 items to measure children's relationship with their mother or primary caregiver. Each item includes two statements, and participants first decide which statement better describes them and then rate the statement on two scales of "sort of true for me" or "really true for me." Sample items include "Some kids worry that their mom might not be there when they need her – Other kids are sure their mom will be there when they need her," and "Some kids find it easy to trust their mom – Other kids are not sure if they can trust their mom." The rating scale for each item was converted to 1 to 4, with higher scores indicating greater secure attachment. Internal consistency reliability estimate was .77.

Fast LH behavioral profiles measured at time 3 when adolescents were 17 years old

Aggressive and exclusive sociality that is adaptive in a precarious environment to address immediate survival concerns aligns with fast pace of life (Chang et al., 2019b; Figueredo et al., 2018), and impulsivity and risk preference covary in predictable ways with fast LH traits (Sear, 2020). Thus, we used these three indicators to form the fast LH behavioral profiles construct.

Aggression. Fathers and mothers completed 20 items of the Child Behavior Checklist (CBCL; Achenbach, 1991) to measure aggression (e.g., "argues a lot," "gets in many fights," and "threatens people"). A 3-point scale ranging from 0 = "never" to 2 = "often" registers the frequency an adolescent engaged in each of these behaviors. Internal consistency reliability estimates were .88 and .87 for fathers and mothers, respectively. The correlation between the two ratings was .56, well justifying averaging the two parental ratings to form the aggression indicator.

Impulsivity. Adolescents completed an 8-item scale of impulsivity selected from the 30-item Barratt Impulsiveness Scale (Patton et al., 1995; Steinberg et al., 2013). Sample items include "I do not pay attention" and "I plan what I have to do (reverse coded)." The items were rated on a 4-point scale ranging from 1 (*never true*) to 4 (*always true*). The internal consistency reliability estimate was .67.

Risk preference. Following the literature (e.g., Duell et al., 2016), we adapted a self-report measure of risk preference (Benthin et al., 1993). Adolescents were asked about the following nine scenarios involving risky behavior: smoking cigarettes, drinking alcohol, vandalizing property, going to dangerous places, riding in cars with drunk drivers, having unprotected sex, stealing from stores, engaging in gang fights, and using weapons to threaten someone. For each scenario, adolescents rated two questions on 4-point scales: "How would you compare the benefits of this activity with the risks?" (1 = *the risks are far greater than the benefits;* 4 = *the benefits are far greater than the risks*), "If something bad happened because of this activity, how serious would it be?" (1 = *not at all serious;* 4 = *very serious*). The average of the two ratings for the nine scenarios formed the construct, with a higher score indicating a greater degree of risk preference. The internal consistency reliability estimate was .88.

Analytic strategy

Because we used latent constructs rather than directly observed variables, we conducted structural equation modeling using *Mplus* 7.0 (Muthén & Muthén, 1998–2012), and we used full information

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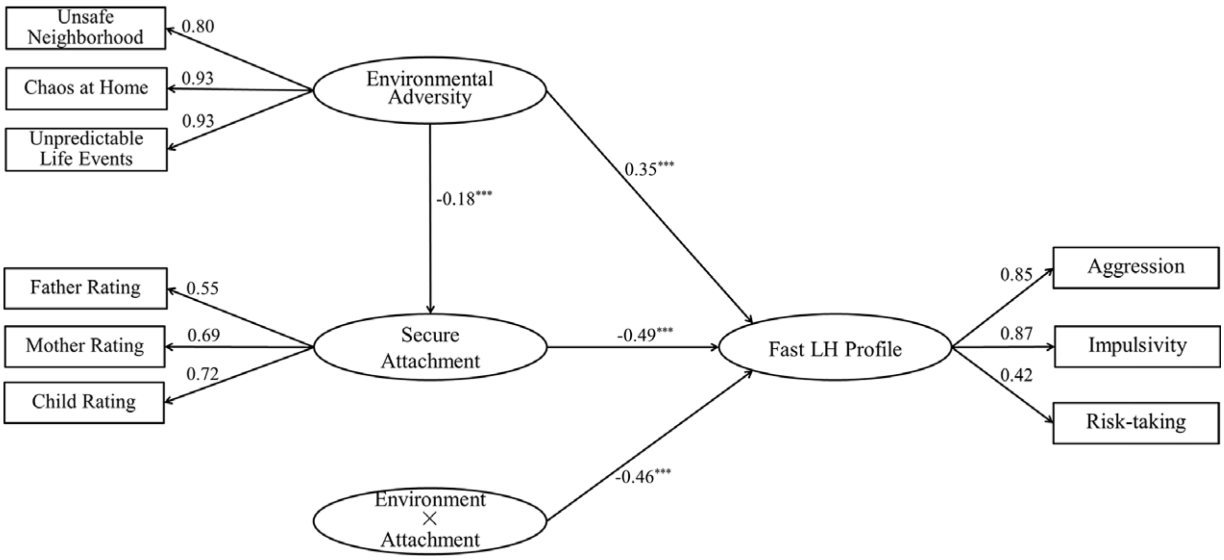

Figure 1. Childhood environmental adversity, secure attachment, and their interaction in relation to fast life history behavioral profile. ***$p < .001$.

maximum likelihood estimation to account for missing data (Schafer & Graham, 2002). We adopted the following recommended cutoff values to assess model fit: chi-square to degrees of freedom ratio (χ^2/df <5.0; Kline, 1998), comparative fit index (CFI ≥ .90; Marsh et al., 1988), Tucker-Lewis index (TLI ≥ .90; Marsh et al., 1988), root mean squared error of approximation (RMSEA ≤ 0.08; Browne & Cudeck, 1993), standardized root mean square residual (SRMR ≤ 0.08; Hu & Bentler, 1999), and minimum factor loading (loading > .32; Tabachnick & Fidell, 2013).

When testing an interaction or moderation model, the two variables forming an interaction or moderation (environmental adversity and secure attachment) are typically treated as correlated with unspecified causal directions. Because we also formulated a mediation hypothesis involving attachment as the mediator, in the model presented in Figure 1, environmental adversity and secure attachment were specified as one leading to the other rather than as two correlates. Statistical estimation of the interaction or moderation effect remains the same whether the two main effect variables, environmental adversity and secure attachment, represent directional or nondirectional relations. Our moderation hypothesis concerns the directional association of environmental adversity leading to fast LH behavioral profiles just as when the interaction or moderation is formed by environmental adversity and secure attachment as two correlates. We computed the interaction construct by using the default approach of M*plus* rather than manually pairing the indicators of the two constructs and multiplying them (Marsh et al., 2004). The M*plus* default approach does not provide goodness-of-fit statistics (Maslowsky et al., 2015; Muthén & Muthén, 1998–2012). Instead, M*plus* provides a measure, D, of relative fitness of the interaction model compared to the main-effect-only model without the interaction term. D is the difference of the log-likelihood values of the two models (D = −2 × [(log-likelihood for the main effect model) − (log-likelihood for the interaction model)]; Muthén & Muthén, 1998–2012). D follows a chi-square distribution with *DF* being the difference in the number of estimated parameters between the two models, which, in the present case, was 1.

Results

Table 1 presents the *M*s, *SD*s, and correlations of all the variables used in the study. The correlations were based on different informants (i.e., adolescents, mothers, and fathers), over time lags of up to 8 years, and across diverse cultural groups. They showed good convergent and discriminant validity with mono-trait measures more highly correlated with each other than with hetero-trait measures. Inter-trait correlations were also in expected directions, with indicators of environmental adversity (e.g., unpredictable life events obtained from mothers) longitudinally and significantly correlated with indicators of fast LH behavioral profiles (i.e., aggression, impulsivity, risk preference reported by adolescents). These indicators were also correlated with secure attachment in the expected directions. We also present the *M*s and *SD*s of the variables for the two genders in Table 2. Boys scored significantly higher than girls on two of the fast LH behavioral indicators. There were no directional or substantial differences in the zero-order correlations or structural relations between the two genders and across 10 cultural groups.

We initially examined and found support for measurement invariance across sites. The measurement model was identified by a confirmatory factor analysis in all 10 sites as the best fitting model with adequate measurement properties. Subsequent measurement invariance tests based on the alignment method (Asparouhov & Muthén, 2014) of M*plus* revealed fewer than 4% noninvariant measurements which was far below the 20%–25% minimum noninvariance threshold (Muthén & Asparouhov, 2014). We then conducted the full structural equation modeling analysis and tested the mediation model without the interaction term. The goodness-of-fit statistics ($\chi^2/df = 4.99$, CFI = 0.96, TLI = 0.94, RMSEA = 0.070, SRMS = 0.056) of the model met the recommended cutoff values for adequate model fit. As shown in Figure 1, all parameter estimates were in the expected directions and were statistically significant. The factor loadings were adequate and were robust even though the indicators were obtained from different informants and some (e.g., proxies of environmental adversity) are not expected to be highly correlated in approximating diverse environmental conditions. Similarly, parameter estimates of the structural model were

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Table 1. Correlations, means, and standard deviations of variables used in the study

	1	2	3	4	5	6	7	8	9
Environmental adversity									
1. Unsafe Neighborhood	–								
2. Chaos in the Home	.67***	–							
3. Unpredictable Life Events	.54***	.55***	–						
Secure Attachment									
4. Father Rating	−.25***	−.40***	−.35***	–					
5. Mother Rating	−.05	−.12***	−.12***	.38***	–				
6. Child Rating	−.12***	−.19***	−.11***	.42***	.51***	–			
Fast LH Behavioral Profile									
7. Aggression	.20***	.28***	.19***	−.20***	−.20***	−.19***	–		
8. Impulsivity	.05	.16***	.10**	−.08†	−.16***	−.16***	.48***	–	
9. Risk Preference	.11**	.25***	.17***	−.16***	−.05	−.07†	.20***	.25***	–
M	0.64	2.24	1.44	6.00	6.08	3.23	0.23	2.00	1.53
SD	0.51	0.55	1.73	1.39	1.42	0.57	0.23	0.47	0.42

†$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$.

Table 2. Gender differences of variables used in the study

	Males		Females		
	M	*SD*	*M*	*SD*	*t*-test
Environmental adversity					
1. Unsafe Neighborhood	0.62	0.50	0.67	0.51	−1.63
2. Chaos in the Home	2.25	0.53	2.24	0.57	0.38
3. Unpredictable Life Events	0.14	0.17	0.15	0.18	−0.71
Secure Attachment					
4. Father Rating	5.92	1.47	6.09	1.29	−1.65
5. Mother Rating	6.14	1.36	6.03	1.46	1.13
6. Child Rating	3.27	0.52	3.19	0.60	2.20*
Fast LH Behavioral Profile					
7. Aggression	0.22	0.23	0.24	0.24	−1.28
8. Impulsivity	2.03	0.43	1.97	0.50	1.98*
9. Risk Preference	1.61	0.42	1.45	0.40	5.72***

*$p < .05$, ***$p < .001$.

consistent with our hypotheses. Environmental adversity was negatively associated with secure attachment ($\beta = -.18$, $p < .001$) and positively predicted fast LH behavioral profile ($\beta = .35$, $p < .001$); secure attachment was negatively related to fast LH behavioral profiles ($\beta = -.49$, $p < .001$). The mediating effect of secure attachment between environmental adversity and fast LH behavioral profiles was significant ($\beta = .10$, 95% CI = [.01, .19]) based on a bootstrapping procedure with 2000 resamples and the maximum likelihood estimation. It represents 26% of the total effect ($\beta = -.44$, $p < .001$) of environmental adversity on fast LH behavioral profiles. These findings support our hypothesis that secure attachment mediates the relation between environmental adversity and fast LH behavioral profiles. Separately, we included family income on a 10-point scale equated across sites and years of education of each parent in the SEM analysis. The results concerning our variables of interest remained the same in terms of statistical significance and relation directionality.

We finally used the default approach of M*plus* to test the moderation hypothesis by comparing the interaction or moderation model with the main-effect only or baseline model, which is our mediation model. The log-likelihood for the main-effect-only or baseline model was −9164.07; and that for the interaction model was = −9156.23; $D = 15.68$, $p < .001$. The statistically significant reduction of the log-likelihood value indicates substantial improvement in data fit by the hypothesized moderation model over the baseline model. For parameter estimation, the interaction between environmental adversity and attachment was significant ($\beta = -.46$, $p < .001$), supporting internal regulation by attachment of the external influence by environmental adversity on fast LH behavioral profiles. Figure 2 displays the simple slopes of environmental adversity on fast LH behavioral profiles at 1 *SD* ($\beta = .07$, *ns*) and −1 *SD* of secure attachment ($\beta = .33$, $p < .001$). Compared to the main effect ($\beta = .35$, $p < .001$), the first simple slope at higher levels of secure attachment was much reduced and nonsignificant, whereas the second simple slope at lower levels of secure attachment remained the same as the main effect. As predicted, secure attachment mainly attenuated or nullified the association of environmental adversity to fast LH behavioral profiles at higher levels of secure attachment, and the negative association was maintained but was not amplified at lower levels of secure attachment (i.e., insecure attachment).

Discussion

Belsky et al. (2010) first identified the effect of caregiver–child attachment on LH outcomes, while Sung et al. (2016) were the first to report the moderating effect of attachment on the relationship between environmental adversity and fast LH. From an internal (mental) state perspective (Nettle et al., 2013), our findings align with those of these pioneering studies. Caregiver–child attachment statistically mediated the longitudinal association between earlier environmental adversity and adolescent fast LH behavioral profiles in the same direction as the external environment. This finding

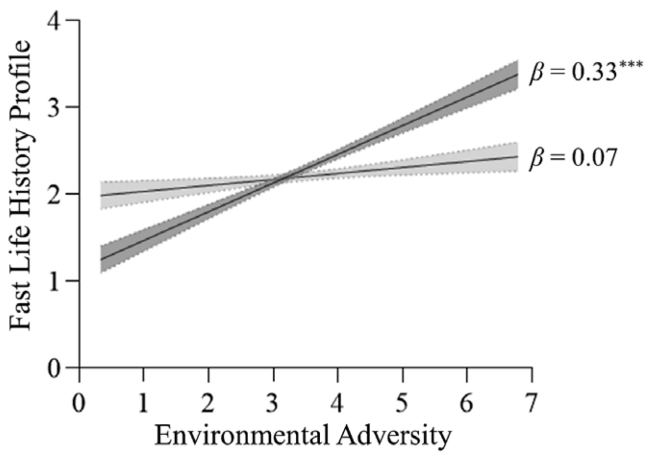

Figure 2. Simple slopes and 95% confidence bands of the regression of fast life history profile on childhood environmental adversity at 1 *SD* above (light) and 1 *SD* below (dark) the mean of secure attachment.

supports the notion that some of the effect attributable to the child's living environment is transmitted to the child through caregiving behaviors and the caregiver's other LH manifestations, which are normally shaped by the same environment that the child inherits from the caregiver (Belsky et al., 1991; Chisholm, 1996). This finding also affirms the logic that internal state is in part caused by and exerts similar influence on LH as the external environment (Chang et al., 2019a). Secure attachment resulting from supportive family environment transmits the same fitness enhancing effect on LH development as the supportive and stable environment. Dysfunctional parenting and insecure attachment that are caused by and in turn transmute environmental adversities into fast LH strategies perpetuate but do not intensify the species-general contingency between the living environment and LH strategies.

The more significant finding is the statistical moderation of attachment. Consistent with our hypothesis, secure attachment primarily functions to downregulate or nullify the effects of the external environment on LH behavioral profiles, rather than insecure attachment upregulating or strengthening these effects. The evolutionary function of caregiving and parenting, which forms caregiver–child attachment, is to protect offspring from mortality threats (e.g., protection from predation; Bowlby, 1969), aligning with the mortality-reduction function of slow LH. Parenting and the resulting attachment foster not only the knowledge and skills necessary to master the environment but also the associated mindset about the self in relation to the world. Established early in childhood as secure attachment and an efficacious internal working model, the internalization of the mental representation of the world as controllable and predictable, and of the self as capable and efficacious, potentially shifts species expectations about extrinsic mortality threats. Instead of perceiving extrinsic mortality threats as uncontrollable and inescapable, the parentally socialized mindset may view them as controllable and reducible. A pervasive belief in the controllability, dependability, and predictability of the external environment, combined with substantive knowledge, skills, and cognitive abilities to conquer nature, enables well-socialized human offspring to manage mortality threats in their living environment. Such an internal state effectively redirects the developmental trajectory from a species-general, adversity-contingent fast track, which disregards mortality and accelerates reproduction, to a slow pathway aimed at reducing extrinsic risks, delaying reproduction, and subsequently slowing LH.

These findings also support the internal models of LH development (e.g., Nettle et al., 2013). Organisms actively regulate external effects through internal somatic and cognitive adjustments rather than responding passively to the environment. The somatic and mental statuses of individuals, responsible for the internal adjustment of external environmental effects, create phenotypic variations within species, which are the basis of human LH research. In the present study, individual differences in attachment and related internal working models enable individuals to respond to environmental adversities differently, accounting for observed variations in LH behavioral profiles. According to internal models in general and the attachment-specific internal model investigated here, extrinsic mortality risks may not uniformly affect age-specific populations but may respond to the mortality-reduction efforts and abilities of individuals. Extrinsic mortality risks can be rendered controllable depending on the intrinsic physical and cognitive attributes of individuals. This observation challenges the prediction of the species-general LH principle, which emphasizes extrinsic mortality risks causing indiscriminate casualties independent of individuals' survival abilities and efforts. While existing internal models are based on internal body states (Chang et al., 2019a), the present study includes mental states in intrinsic mortality–vitality determination. Just as a sound internal body state can influence responses to external threats, the internalized secure mental representation of the external environment in relation to the self may shift one's perception of extrinsic mortality threats from being uncontrollable and inescapable to being controllable and reducible.

The present study has certain limitations. Most notably, the childhood environment variables were collected when the children were 10 years old. However, family environments remained stable throughout the data collection phases of the study that started when children were 8 years old on average. The items (e.g., "My neighborhood is a nice place to live." "The atmosphere in our home is calm.") reflect a consistent state of affairs over an extended period up to the time of the interviews reported in this study. Respondents were also asked to reflect on their past experiences. Thus, these variables effectively captured early or earlier childhood environments, potentially including more critical periods of LH development. We measured attachment during adolescence, but attachment, which is primarily formed during early childhood, remains relatively stable throughout life (Main, 1991). Finally, as suggested by one of the reviewers, race is highly relevant to LH processes (Rushton, 1996). Our multi-country data allow for comparative investigations across both racial and cultural dimensions, which future research may explore. Despite these and other limitations, our study represents one of the first theoretical and empirical attempts to conceptualize attachment as an internal state in slowing human LH, in addition to mediating the species-general environmental contingency on LH development.

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References

Achenbach, T. M. (1991). *Manual for the child behavior checklist/4-18 and 1991 profile*. University of Vermont, Department of Psychiatry.

Ainsworth, M. D. S. (1978). The Bowlby-Ainsworth attachment theory. *Behavioral and Brain Sciences*, *1*(3), 436–438. https://doi.org/10.1017/S0140525X00075828

Arend, R., Gove, F. L., & Sroufe, L. A. (1979). Continuity of individual adaptation from infancy to kindergarten: A predictive study of ego-resiliency and curiosity in preschoolers. *Child Development*, *50*(4), 950–959. https://doi.org/10.2307/1129319

Asparouhov, T., & Muthén, B. (2014). Multiple-group factor analysis alignment. *Structure Equation Modeling*, *21*(1), 1–14. https://doi.org/10.1080/10705511.2014.919210.

Barbaro, N., & Shackelford, T. K. (2019). Environmental unpredictability in childhood is associated with anxious romantic attachment and intimate partner violence perpetration. *Journal of Interpersonal Violence*, *34*(2), 240–269. https://doi.org/10.1177/0886260516640548

Belsky, J. (2012). The development of human reproductive strategies: Progress and prospects. *Current Directions in Psychological Science*, *21*(5), 310–316. https://doi.org/10.1177/0963721412453588

Belsky, J. (2019). Early-life adversity accelerates child-adolescent development. *Current Directions in Psychological Science*, *28*(3), 241–246. https://doi.org/10.1177/0963721419837670

Belsky, J., Houts, R. M., & Fearon, R. P. (2010). Infant attachment security and the timing of puberty: Testing an evolutionary hypothesis. *Psychological Science*, *21*(9), 1195–1201. https://doi.org/10.1177/0956797610379867

Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development*, *62*(4), 647–670. https://doi.org/10.1111/j.1467-8624.1991.tb01558.x.

Benthin, A., Slovic, P., & Severson, H. (1993). A psychometric study of adolescent risk perception. *Journal of Adolescence*, *16*(2), 153–168. https://doi.org/10.1006/jado.1993.1014

Bornstein, M. H. (2019). Parenting infants. In M. H. Bornstein (Eds.), *Handbook of parenting. Vol. 1. Children and parenting*, (3th edn. pp. 3–55). Routledge.

Bowlby, J. (1969/1982). *Attachment and loss: Vol. I: Attachment*, (2nd edn.) Basic Books.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen, & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Sage.

Carnes, B. A., Holden, L. R., Olshansky, S. J., Witten, M. T., & Siegel, J. S. (2006). Mortality partitions and their relevance to research on senescence. *Biogerontology*, *7*(4), 183–198. https://doi.org/10.1007/s10522-006-9020-3

Cassidy, J. (1986). The ability to negotiate the environment: An aspect of infant competence as related to quality of attachment. *Child Development*, *57*(2), 331–337. https://doi.org/10.2307/1130588

Chang, L., Liu, Y. Y., Lu, H. J., Lansford, J. E., Bornstein, M. H., Steinberg, L., Deater-Deckard, K., Rothenberg, A. W., Skinner, A., & Dodge, K. A. (2021). Slow life history strategies and increases in externalizing and internalizing problems during the COVID-19 pandemic. *Journal of Research on Adolescence: the Official Journal of the Society for Research on Adolescence*, *31*(3), 595–607. https://doi.org/10.1111/jora

Chang, L., Lu, H. J., Lansford, J. E., Bornstein, M. H., Steinberg, L., Chen, B., Skinner, A. T., Dodge, K. A., Deater-Deckard, K., Bacchini, D., Pastorelli, C., Alampay, L. P., Tapanya, S., Sorbring, E., Oburu, P., Al-Hassan, S., Di Giunta, L., Malone, P. S., Uribe Tirado, L. M., & Yotanyamaneewong, S. (2019a). External environment and internal state in relation to life history behavioral profiles of adolescents in nine countries. *Proceedings of the Royal Society B: Biological Sciences*, *286*(1917), 20192097. https://doi.org/10.1098/rspb.2019.2097

Chang, L., Lu, H. J., Lansford, J. E., Skinner, A. T., Bornstein, M. H., Steinberg, L., Dodge, K., Chen, B. B., Tian, Q., Bacchini, D., Deater-Deckard, K., Pastorelli, C., Alampay, L. P., Sorbring, E., Al-Hassan, S. M., Oburu, P., Malone, P. S., Di Giunta, L., Uribe Tirado, L. M., & Tapanya, S. (2019b). Environmental harshness and unpredictability, life history, and social and academic behavior of adolescents in nine countries. *Developmental Psychology*, *55*(4), 890–903. https://doi.org/10.1098/rspb.2019.2097

Chen, B. B., & Chang, L. (2012). Adaptive insecure attachment and its relationships with resource control strategies during middle childhood. *International Journal of Behavioral Development*, *36*(5), 389–397. https://doi.org/10.1177/0165025412445440

Chisholm, J. S. (1993). Death, hope, and sex: Life-history theory and the development of reproductive strategies [and Comments and Reply]. *Current Anthropology*, *34*(1), 1–24. https://doi.org/10.1086/204131

Chisholm, J. S. (1996). The evolutionary ecology of attachment organization. *Human Nature*, *7*(1), 1–37. https://doi.org/10.1007/BF02733488

Clutton-Brock, T. H. (1984). Reproductive effort and terminal investment in iteroparous animals. *The American Naturalist*, *123*(2), 212–229. https://doi.org/10.1086/284198

Corcoran, M., & McNulty, M. (2018). Examining the role of attachment in the relationship between childhood adversity, psychological distress and subjective well-being. *Child Abuse & Neglect*, *76*, 297–309. https://doi.org/10.1016/j.chiabu.2017.11.012

Del Giudice, M., & Belsky, J. (2011). The development of life history strategies: Toward a multi-stage theory. In D. M. Buss, & P. H. Hawley (Eds.), *The evolution of personality and individual differences* (pp. 154–176). Oxford University Press.

Duell, N., Steinberg, L., Chein, J., Al-Hassan, S. M., Bacchini, D., Lei, C., Chaudhary, N., Di Giunta, L., Dodge, K. A., Fanti, K. A., Lansford, J. E., Malone, P. S., Oburu, P., Pastorelli, C., Skinner, A. T., Sorbring, E., Tapanya, S., Uribe Tirado, L. M., Alampay, L. P. (2016). Interaction of reward seeking and self-regulation in the prediction of risk taking: A cross-national test of the dual systems model. *Developmental Psychology*, *52*(10), 1593–1605. https://doi.org/10.1037/dev0000152

Ellis, B. J., Shakiba, N., Adkins, D. E., & Lester, B. M. (2021). Early external-environmental and internal-health predictors of risky sexual and aggressive behavior in adolescence: An integrative approach. *Developmental Psychobiology*, *63*(3), 556–571. https://doi.org/10.1002/dev.22029.

Figueredo, A. J., Jacobs, W. J., Gladden, P. R., Bianchi, J., Patch, E. A., Kavanagh, P. S., Beck, C. J. A., Sotomayor-Peterson, M., Jiang, Y., & Li, N. P. (2018). Intimate partner violence, interpersonal aggression, and life history strategy. *Evolutionary Behavioral Sciences*, *12*(1), 1–31. https://doi.org/10.1037/ebs0000101

Hartman, S., Li, Z., Nettle, D., & Belsky, J. (2017). External-environmental and internal-health early-life predictors of adolescent development. *Development and Psychopathology*, *29*(5), 1839–1849. https://doi.org/10.1017/S0954579417001432

Hartman, S., Sung, S., Simpson, J. A., Schlomer, G. L., & Belsky, J. (2018). Decomposing environmental unpredictability in forecasting adolescent and young adult development: A two-sample study. *Development and Psychopathology*, *30*(4), 1321–1332. https://doi.org/10.1017/s0954579417001729

Hazan, C., & Shaver, P. R. (1987). Romantic love conceptualized as an attachment process. *Journal of Personality and Social Psychology*, *52*(3), 511–524. https://doi.org/10.1037/0022-3514.52.3.511

Hill, E. M., Young, J. P., & Nord, J. L. (1994). Childhood adversity, attachment security, and adult relationships: A preliminary study. *Ethology and Sociobiology*, *15*(5-6), 323–338. https://doi.org/10.1016/0162-3095(94)90006-X

Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research*, *11*(2), 213–218. https://doi.org/10.1016/0022-3999(67)90010-4

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Kerns, K. A., Klepac, L., & Cole, A. (1996). Peer relationships and preadolescents' perceptions of security in the child-mother relationship. *Developmental Psychology*, *32*(3), 457–466. https://doi.org/10.1037/0012-1649.32.3.457

Kerns, K. A., Schlegelmich, A., Morgan, T. A., & Abraham, M. M. (2005). Assessing attachment in middle childhood. In K. A. Kerns, & R. A. Richardson (Eds.), *Attachment in middle childhood* (pp. 46–70). Guilford Press.

Kerns, K. A., Tomich, P. L., Aspelmeier, J. E., & Contreras, J. M. (2000). Attachment-based assessments of parent-child relationships in middle childhood. *Developmental Psychology*, *36*(5), 614–626. https://doi.org/10.1037/0012-1649.36.5.614

Kline, R. B. (1998). *Principles and practice of structural equation modeling*. Guilford Press.

Lafferty, K. D. (1993). The marine snail. Cerithidea californica, matures at smaller sizes where parasitism is high. *Oikos*, *68*(1), 3–3. https://doi.org/10.2307/3545303

Le, T. L., Levitan, R. D., Mann, R. E., & Maunder, R. G. (2018). Childhood adversity and hazardous drinking: The mediating role of attachment insecurity. *Substance Use & Misuse*, *53*(8), 1387–1398. https://doi.org/10.1080/10826084.2017.1409764

Lewis, M., & Goldberg, S. (1969). Perceptual-cognitive development in infancy: A generalized expectancy model as a function of the mother-infant interaction. *Merrill-Palmer Quarterly of Behavior and Development*, *15*(1), 81–100. https://www.jstor.org/stable/23082954

Lu, H. J., Liu, Y. Y., & Chang, L. (2022). Child attachment in adjusting the species-general contingency between environmental adversities and fast life history strategies. *Development and Psychopathology*, *34*(2), 719–730. https://doi.org/10.1017/S0954579421001413

Lu, H. J., Liu, Y. Y., J., O., Guo, S., Zhu, N., Chen, B. B., Lansford, J. E., & Chang, L. (2021). Disease history and life history predict behavioral control of the COVID-19 pandemic. *Evolutionary Psychology*, *19*(1), 14747049211000714. https://doi.org/10.1177/14747049211000714

Main, M. (1991). Metacognitive knowledge, metacognitive monitoring, and singular (coherent) vs. multiple (incoherent) model of attachment: Findings and directions for future research. In C. M. Parkes, J. Stevenson-Hinde, & P. Marris (Eds.), *Attachment across the life cycle* (pp. 127–159). Routledge.

Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness of fit indices in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin*, *103*(3), 391–441. https://doi.org/10.1037/0033-2909.103.3.391

Marsh, H. W., Wen, Z., & Hau, K. T. (2004). Structural equation models of latent interactions: Evaluation of alternative estimation strategies and indicator construction. *Psychological Methods*, *9*(3), 275–300. https://doi.org/10.1037/1082-989X.9.3.275

Maslowsky, J., Jager, J., & Hemken, D. (2015). Estimating and interpreting latent variable interactions: A tutorial for applying the latent moderated structural equations method. *International Journal of Behavioral Development*, *39*(1), 87–96. https://doi.org/10.1177/0165025414552301

Matheny A. P., Wachs, T. D., Ludwig, J. L., & Phillips, K. (1995). Bringing order out of chaos: Psychometric characteristics of the confusion, hubbub, and order scale. *Journal of Applied Developmental Psychology*, *16*(3), 429–444. https://doi.org/10.1016/0193-3973(95)90028-4

Murray, C., & Greenberg, M. T. (2006). Examining the importance of social relationships and social contexts in the lives of children with high-incidence disabilities. *The Journal of Special Education*, *39*(4), 220–233. https://doi.org/10.1177/00224669060390040301

Muthén, B., & Asparouhov, T. (2014). IRT studies of many groups: The alignment method. *Frontiers in Psychology*, *5*, 978. https://doi.org/10.3389/fpsyg.2014.00978

Muthén, L. K., & Muthén, B. O. (1998-2012). *Mplus user's guide* (7th edn.). Muthén & Muthén.

Nettle, D., & Bateson, M. (2015). Adaptive developmental plasticity: What is it, how can we recognize it and when can it evolve? *Proceedings of the Royal Society B: Biological Sciences*, *282*(1812), 20151005. https://doi.org/10.1098/rspb.2015.1005

Nettle, D., Frankenhuis, W. E., & Rickard, I. J. (2013). The evolution of predictive adaptive responses in human life history. *Proceedings of the Royal Society B: Biological Sciences*, *280*(1766), 20131343. https://doi.org/10.1098/rspb.2013.1343

Oppliger, A., Richner, H., & Christe, P. (1994). Effect of an ectoparasite on lay date, nest-site choice, desertion, and hatching success in the great tit (Pants major). *Behavioral Ecology*, *5*(2), 130–134. https://doi.org/10.1093/beheco/5.2.130

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology*, *51*(6), 768–774. https://doi.org/10.1002/1097-4679(199511)51:6<768::aid-jclp2270510607>3.0.co;2-1

Pauletti, R. E., Cooper, P. J., Aults, C. D., Hodges, E. V., & Perry, D. G. (2016). Sex differences in preadolescents' attachment strategies: Products of harsh environments or of gender identity? *Social Development*, *25*(2), 390–404. https://doi.org/10.1111/sode.12140

Rushton, J. P. (1996). *Race, evolution, and behavior: A life history perspective*. Transaction Publishers.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, *7*(2), 147–177. https://doi.org/10.1037//1082-989X.7.2.147

Sear, R. (2020). Do human life history strategies exist? *Evolution and Human Behavior*, *41*(6), 513–526. https://doi.org/10.1016/j.evolhumbehav.2020.09.004

Simpson, J. A., & Belsky, J. (2008). Attachment theory within a modern evolutionary framework. In J. Cassidy, & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 131–157). Guilford Press.

Steinberg, L., Sharp, C., Stanford, M. S., & Tharp, A. T. (2013). New tricks for an old measure: The development of the Barratt Impulsiveness Scale-Brief (BIS-Brief). *Psychological Assessment*, *25*(1), 216–226. https://doi.org/10.1037/a0030550

Sung, S., Simpson, J. A., Griskevicius, V., Kuo, S. I. C., Schlomer, G. L., & Belsky, J. (2016). Secure infant-mother attachment buffers the effect of early-life stress on age of menarche. *Psychological Science*, *27*(5), 667–674. https://doi.org/10.1177/0956797616631958

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th edn.). Pearson.

Tharner, A., Luijk, M. P., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Jaddoe, V. W., Hofman, A., Verhulst, F. C., & Tiemeier, H. (2012). Infant attachment, parenting stress, and child emotional and behavioral problems at age 3 years. *Parenting*, *12*(4), 261–281. https://doi.org/10.1080/15295192.2012.709150

Thompson, R. A. (2021). Internal working models as developing representations. In R. A. Thompson, J. A. Simpson, & L. J. Berlin (Eds.), *Attachment: The fundamental questions*. The Guilford Press.

Waynforth, D. (2012). Life-history theory, chronic childhood illness and the timing of first reproduction in a British birth cohort. *Proceedings of the Royal Society B: Biological Sciences*, *279*(1740), 2998–3002. https://doi.org/10.1098/rspb.2012.0220

White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*, *66*(5), 297–333. https://doi.org/10.1037/h0040934

Whittenburg, P. N., Stern, J. A., Brett, B. E., Straske, M. D., & Cassidy, J. (2023). Maternal depressive symptoms and child behavior problems: Attachment security as a protective factor. *Development and Psychopathology*, *35*(2), 678–688. https://doi.org/10.1017/S0954579421001802

Williams, G. C. (1957). Pleiotropy, natural selection, and the evolution of senescence. *Evolution*, *11*(4), 398–411. https://doi.org/10.2307/2406060

Yang, Y., & Perkins, D. R. (2020). Association between childhood adversity and criminal thinking: The role of attachment. *Psychology, Crime & Law*, *27*(8), 796–814. https://doi.org/10.1080/1068316X.2020.1850724

Young, E. S., Frankenhuis, W. E., & Ellis, B. J. (2020). Theory and measurement of environmental unpredictability. *Evolution and Human Behavior*, *41*(6), 550–556. https://doi.org/10.1016/j.evolhumbehav.2020.08.006

Zimmermann, P. (1999). Structure and functions of internal working models of attachment and their role for emotion regulation. *Attachment & Human Development*, *1*(3), 291–306. https://doi.org/10.1080/146167399001341