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Strategic and cognitive differentiation–integration effort in a study of 76 countries

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ABSTRACT

The phenomena of strategic and cognitive differentiation and integration (SD–IE and CD–IE) amongst life history indicators and cognitive abilities as a function of level of latent life history speed have been robustly demonstrated in individual differences samples. Here we examine a cross-national sample ($N = 76$ nations) with respect to ten aggregate life history indicators (birth rate, infant mortality, skin reflectance, prevalence of STDs, overall life satisfaction, life expectancy, national IQ, cranial capacity, savings rate and crime rate), all of which share substantive common variance stemming from a K-Super factor which accounts for 66.6% of the variance amongst these indicators. All indicators became significantly less strongly correlated with the super factor as the level of K increased indicating the presence of robust SD–IE effects. A 'cognitive' factor comprised of the national IQ and cranial capacity variables also exhibited differentiation as a function of increasing levels of K, suggesting the presence of CD–IE also. Consistently with the findings of individual differences studies investigating SD–IE, the degree to which the indicators loaded on the K super-factor positively mediated their sensitivity to the effect.

1. Introduction

Life history describes the tendency for organisms to allocate resources into either mating, and thus the generation of surplus population as a means of coping with social and ecological instability (often called a *fast* life history); or parenting, somatic maintenance and community building (i.e. nepotistically), as a means of ensuring maximal organism quality and competitiveness given an environment in which social and ecological stability will ensure biotic saturation and competition over resources (often called a *slow* life history; MacArthur & Wilson, 1967; Pianka, 1970). Within human populations, variation in the speed of life history has been theoretically linked to both individual and group differences in personality, behaviour, intelligence and health (Rushton, 1985, 2000). At the individual differences level, global measures of personality, health and social behaviour all share common genetic variance with one another, giving rise to a superordinate dimension of life history *speed* termed *Super-K* (Figueredo & Rushton, 2009). At the individual differences level, intelligence does not correlate with speed of life history however, contrary to predictions (Woodley, 2011a). This may be because the *g*-factor of intelligence results from mutation selection balance, and therefore is a fitness indicator, rather than a true life history variable, variation in which may relate more strongly to balancing selection operating on polymorphisms (Penke, Denissen, & Miller, 2007; Woodley, 2011a). At the group differences level, national IQ and national life history aggregates do correlate strongly however (Boutwell et al., 2013; Meisenberg & Woodley, 2013; Templer, 2008). This apparent contradiction has been termed the *Rushton Paradox* (Meisenberg & Woodley, 2013). Possible solutions to the paradox include the idea that the national-level correlations result from population stratification reflecting historical co-selection for both slow life history and high IQ, or that national IQ is qualitatively different from individual differences level IQ and somehow captures variance that is related to life history (Meisenberg & Woodley, 2013; Woodley, 2011b).

1.1. Specialism and generalism as part of the life history matrix

Another solution to the Rushton Paradox is that life history and intelligence do interact, just not at the level of a main effect of one latent variable on the other. Instead it has been proposed that part of the slow life history strategy is to become a cognitive specialist, which should aid in the navigation of complex and crowded environments. Conversely part of the fast life history strategy is to become a cognitive generalist, which would permit contingent switching between unstable ecological niches (Woodley, 2011a).

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This cognitive differentiation–integration effort (CD–IE) trade-off hypothesis has been validated in student samples, in addition to the demographically representative National Longitudinal Survey of Youth (NLSY) and also in an ethnic differences sample (Woodley, Figueredo, Brown, & Ross, 2013). In all cases CD–IE effects are present despite there being no correlation between *g* and *K*. The same logic behind CD–IE should also apply to the correlations amongst non-cognitive life history indicators, as part of the slow life history strategy should involve populations becoming more differentiated overall – consequently giving rise to a potentially very large range of cognitive, conative and behavioral slow life history morphs, which can diversify with respect to a variety of niches, and even construct new ones. The net effect of this will be to boost the carrying capacity of an environment, as fine-grained divisions of labour will raise the aggregate efficiency of populations in which they are commonplace (Figueredo, Woodley, Brown, & Ross, 2013; Woodley, 2011a). This strategic differentiation–integration effort (SD–IE) model has been validated now in several student samples and also in the demographically representative NLSY and the Midlife in the United States (MIDUS) datasets (Figueredo, Cabeza de Baca, & Woodley, 2013). SD–IE has also been detected on five aggregate life history measures comprising a *K* Super-factor at the level of the 50 states of the US, indicating that it generalizes from the individual differences to the population level of analysis (Fernandes & Woodley, 2013).

In the present study we examine a cross-national dataset for evidence that SD–IE and CD–IE trade-offs occur at higher levels of inter-population variability. Successfully detecting these effects at such a large inter-population scale would serve as an important validation, not only of attempts to measure life history at high levels of aggregation, but would also demonstrate the pervasiveness of these differentiation–integration effort tradeoffs across human phylogenies.

2. Methods

2.1. Measures

Many different life history indicators have been found to share substantive variance at cross-national scales. These include measures of longevity, skin reflectance, fertility, disease prevalence, national IQ, education, crime prevalence, economic development and behaviour (Meisenberg & Woodley, 2013; Rushton & Templer, 2009; Templer, 2008; Templer & Rushton, 2011; Woodley, 2011b). From the list of potential variables we select ten life history indicators:

(i) *Birth rate* (data from the *CIA World Factbook,* 2006). This functions as an indicator of fertility, and hence mating effort.
(ii) *Infant mortality* (data from the *CIA World Factbook,* 2006). This functions as an indicator of social and environmental instability (Ellis, Figueredo, Brumbach, & Schlomer, 2009).
(iii) A combined Skin color and reflectance measure (recoded as *Skin reflectance* with a positive loading on our K super-factor; data from Meisenberg (2003) and Templer and Arikawa (2006)). Skin reflectance is positively associated with slow life history in mammals via the melanocortin system (Ducrest, Keller, & Roulin, 2008; Rushton & Templer, 2012).
(iv) *Rate of Sexually transmitted diseases (STDs)* (data from the *World Health Report* of the WHO, 2004 edition). This includes syphilis, gonorrhoea and chlamydia. HIV/AIDS is not included due to its recent African origin, which affects its present geographical distribution. As a biomedical indicator of health outcomes, rate of STDs can be seen as a component of *Covitality* (Weiss, King, & Enns, 2002).
(v) *Overall life satisfaction* (data from the *Gallup World Poll,* 2006–2009 average). This functions as an indicator of subjective well-being, which is a component of the *covitality* factor of life history (Figueredo, Vásquez, Brumbach, & Schneider, 2004; Weiss et al., 2002).
(vi) *Life expectancy* (data from the *CIA World Factbook,* 2006). This functions as a global physical health indicator, and, like overall life satisfaction, is a component of *Covitality* (Figueredo et al., 2013).
(vii) *Cranial capacity* (data from Beals, Smith, & Dodd, 1984). It has been argued that cranial capacity relates to life history, as bigger brains take longer to develop and require more specialized somatic effort allocation (Rushton & Ankney, 2009).
(viii) *National IQ* (data from Lynn & Vanhanen, 2006). It has been argued that IQ is part of life history, owing to its association with brain size (Rushton, 2000, 2010).
(ix) *Savings rate* (1975–2005 average, data from the *World Bank*) is gross domestic savings. Savings rate constitutes a measure of time preferences – a basic dimension of life history (Meisenberg & Woodley, 2013).
(x) *Crime rate* (data from the *Gallup World Poll*). This measures crime victimization, and it is the unrotated first principal component of the proportions of each population that, during the last year, reported theft, assault/mugging, and felt unsafe on the streets at night. Crime seems to be associated with low impulse control and fast life history (Rushton & Whitney, 2002).

All cases with missing data were excluded leaving 76 nations in total. These measures constitute a broad array of potential life history indicators. We also excluded New World countries (following the protocol of Templer, 2008), as European populations settled these regions and engaged in admixture with the resident populations relatively recently in history, thus the pattern of life history traits exhibited by these populations may reflect the heterogeneous ancestry of these populations rather than adaptation to the conditions of the New World.

Table 1 indicates that, consistent with previous findings, the ten life history variables load preferentially on one common *K Super-factor*.

A principal-axis factor analysis of the hypothesized indicators of the K Super-factor (using direct Oblimin rotation) produced a single common factor that explained 66.6% of the reliable variance ($KMO = .90$; $\chi^2 = 768.28$, d.f. = 45, $P < .001$).

2.2. Statistics

In exploring these data for evidence of SD–IE and CD–IE effects, we employed the continuous parameter estimation model (CPEM; Gorsuch, 2005). CPEM uses the cross product of *z*-scores as the

Table 1
Factor pattern for the K Super-factor using Principal Axis Factor analysis (Oblimin rotation).

Life history indicator	Factor loading
Birth rate	.904
Infant mortality	.893
Skin reflectance	.952
STDs rate	.942
Overall life satisfaction	.800
Life expectancy	.926
National IQ	.921
Cranial capacity	.686
Savings rate	.430
Crime rate	.504