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Are Extraversion and Openness Indicators of a Slow Life History Strategy?

Running headline: Extraversion, Openness, and Life History Strategy

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Abstract

Theory and data generally concur that a slower Life History Strategy (LHS) is associated with higher Conscientiousness, Agreeableness and Emotional Stability. Whether Extraversion and Openness are indicators of a slow LH, or whether they include both fast and slow LH components, remains unresolved. I addressed these questions in two studies: one of university students observed via periodic brief audio recordings during 72 hours of their daily lives, and the second a re-analysis of data from Block and Block's (2006) longitudinal study. In both studies, I operationalized LHS as the correlation between an individual's California Q-Sort (CAQ) profile and the slow Life History (SLH) CAQ template created by Sherman et al. (2013) and Dunkel et al. (2015). I calculated Five Factor Model dimension scores using McCrae et al's (1986) method. In both samples, individuals whose CAQ profile more closely resembled the SLH template were higher in Conscientiousness, Agreeableness, and Emotional Stability than those pursuing a faster LHS. Extraversion was unrelated to LHS, while Openness in the Block and Block data set was actually associated with a faster LHS. Analysis of individual CAQ items revealed some differences between the studies. Generally, Extraversion-loading items tapping excitement-seeking and self-dramatization, and Openness-loading items tapping nonconformity, were associated with a faster LHS. Participants in the audio recording study also completed a HEXACO personality inventory and the Arizona Life History Battery. LHS as measured by the ALHB was uncorrelated with LHS as measured by the CAQ. Controlling for Extraversion yielded a significant positive relationship between the two LHS measures, suggesting that their poor convergent validity resulted from differences in their coverage of Extraversion-related content.

Keywords: Life History Strategy; Extraversion; Openness; California Q-Sort; Arizona Life History Battery; Electronically Activated Recorder

1. Introduction

Life history theory (MacArthur & Wilson, 1967; Pianka, 1970) draws attention to the trade-offs that organisms face in allocating limited energy among the competing demands of growth, reproduction (including mating and parenting) and bodily maintenance and repair. Life history theory has proven to be a fruitful source of hypotheses about human individual differences, including personality variation (Figueredo, Vásquez, Brumbach, & Schneider, 2004; Rushton, 1985). A slow Life History Strategy or “speed” (LHS), also known as a high-*K* strategy (Figueredo et al., 2005) prioritizes somatic effort (i.e. investment in future reproduction) over reproductive effort, parental effort over mating effort, and quality of offspring over quantity of offspring, whereas a fast LHS prioritizes their opposites.

Some research supports the existence of an apical personality factor, the General Factor of Personality (GFP: Musek, 2007), which is argued to overlap strongly, both theoretically and empirically, with a slow LHS (Dunkel & Decker, 2010; Figueredo et al., 2004; Figueredo, Vásquez, Brumbach, & Schneider, 2007; Figueredo et al., 2014; Rushton, Bons, & Hur, 2008). The GFP is characterized by high levels of the five major dimensions of personality postulated by the Five Factor Model (FFM: Digman, 1990): Emotional Stability, Extraversion, Openness, Agreeableness and Conscientiousness. Debate continues regarding whether the GFP is merely an artifact of measurement instruments or analytical procedures, rather than a real construct (e.g. de Vries, Tybur, Pollet, & Van Vugt, 2016; Rushton & Irwing, 2011). However, even if the GFP is real, it is not isomorphic with LHS (Figueredo et al., 2014). Some of the variation in the FFM dimensions is not associated with LHS, and facets within one FFM dimension may be related to LHS in opposing directions (Del Giudice, 2012, 2014a). The research described in this paper

does not measure the GFP directly, but rather focuses on how two FFM dimensions, Extraversion and Openness, are related to LHS.

The core feature of Extraversion is thought to be sensitivity to reward (Cloninger, Przybeck, & Svrakic, 1991; Lucas, Diener, Grob, Suh, & Shao, 2000; Nettle, 2006), and its component facets, in the FFM structure, consist of positive emotions, excitement seeking, activity, assertiveness, gregariousness, and interpersonal warmth (Costa & McCrae, 1995). People pursuing a slow LHS, compared to those pursuing a fast LHS, are expected to invest more time and effort in social relationships, which in ancestral environments may have typically entailed short-term costs for which long-term benefits later compensated (Gurven, Allen-Arave, Hill, & Hurtado, 2000). Emphasizing this aspect of Extraversion, some researchers (e.g. Figueredo et al., 2004) have hypothesized a straightforward positive relationship between the *K*-factor (i.e. slow LH) and Extraversion. Several studies using self-report instruments have found support for this hypothesis (Dunkel & Decker, 2010; Figueredo et al., 2004, 2007; Gladden, Figueredo, & Jacobs, 2009). However, one of the foundational formulations of the LHS-based approach to human individual differences (Rushton, 1985) proposed a negative relationship between slow LH and Extraversion. Del Giudice (2012, 2014a) has argued that Extraversion includes both slow LH components (warmth, gregariousness) and fast LH components (sensation-seeking, dominance-striving). Extraversion is positively related to number of sex partners (Nettle, 2005) and either positively related (Holtzman & Strube, 2013; Schmitt & Shackleford, 2008; Simpson & Gangestad, 1991; Wright & Reise, 1997) or unrelated (Bourdage, Lee, Ashton, & Perry, 2007; Manson, 2015; Strouts, Brase, & Dillon, 2016) to self-reported short-term mating orientation. Cortisol reactivity to psychosocial stress may mediate the relationship between Extraversion and unrestricted sociosexuality (Wilson et al., 2015). These

findings suggest a positive relationship between Extraversion and mating effort, and hence a neutral or negative relationship between Extraversion and slow LH.

Personality theorists differ regarding the core feature of Openness. Some (e.g. Denissen & Penke, 2008) emphasize its extensive overlap with the construct *need for cognition* (Cacioppo, Petty, Feinstein, & Jarvis, 1996). In this view, the Openness dimension represents variation in the extent to which a person experiences cognitive activity as rewarding. Thus, from a Life History perspective, high Openness represents a form of somatic effort, specifically investment in acquiring knowledge and skills that, in ancestral environments, typically paid off only after a considerable delay (Kaplan, Hill, Lancaster, & Hurtado, 2000). An alternative view is that the core feature of Openness is a propensity for broad interaction between different psychological domains and information processing streams (McCrae, 1987; Nettle, 2006). Del Giudice (2012, 2014a) argues that Openness includes both these facets and that the first, *intellect*, is associated with a slow LHS while the second, *imagination*, is associated with a fast LHS. Imagination is positively correlated with schizotypal traits (e.g. unusual experiences, tendency toward magical ideation), which in turn are correlated with unrestricted sociosexuality (Del Giudice, 2014a; Del Giudice, Angeleri, Brizio, & Elena, 2010). Studies reporting relationships between self-report Openness measures and self-report LHS measures have yielded mixed results (Dunkel & Decker, 2010; Figueredo et al., 2007; Gladden et al., 2009; Manson, 2015; Strouts et al., 2016).

An alternative approach to the observed mixed relationships between Extraversion and Openness, on one hand, and reproductive strategy indicators, on the other, is to reject Life History Speed as a unidimensional construct (Holtzman & Senne, 2014). In this view, the trade-offs postulated by Life History Theory, particularly the trade-off between short-term mating and long-term mating, are milder than commonly assumed. Some people successfully maintain both

kinds of mating relationships, and Extraversion may facilitate this dual strategy (Holtzman & Strube, 2013). However, sexual strategies are not isomorphic with LHS (Del Giudice, 2014b); they belong to a lower level of analysis, and are products not just of LHS, but also of phenotypic and environmental variables unrelated to LHS. For example, men's physical strength and attractiveness predict variation in uncommitted mating orientation, but not variation in committed mating orientation (Lukaszewski, Larson, Gildersleeve, Roney, & Haselton, 2014). More generally, Life History trade-offs are sufficiently flexible (Reznick, Nunney, & Tessier, 2000) that the unidimensional fast-slow dimension, though a fruitful source of hypothesis, is not expected to explain all or even most of the variation in specific traits.

Of the other three Five Factor Model traits, two (Conscientiousness and Agreeableness) are unequivocally associated with a slow LHS, both theoretically and empirically (Dunkel & Decker, 2010; Figueredo et al., 2007; Gladden et al., 2009; Manson, 2015; Strouts et al., 2016). Conscientiousness can be defined as self-control in the pursuit of long-term goals (Nettle, 2006), and Agreeableness as a propensity toward altruistic behavior (Denissen & Penke, 2008). Emotional Stability has been consistently found to be associated with a slow LHS (Figueredo et al., 2004, 2007; Gladden et al., 2009; Rushton et al., 2008) but questions persist regarding the theoretical coherence (not the psychometric coherence) of the Emotional Stability dimension. When glossed as susceptibility to negative emotions (Nettle, 2006), Neuroticism includes the reaction norms (see Denissen & Penke, 2008) of a diverse set of mechanisms (anger, anxiety, sadness) with distinct functions (Manson, 2015).

The principal goal of the present study is to test between alternative hypotheses regarding the relationship between LHS and the FFM dimensions. Methodologically, I take two approaches. First, I build on the work of Sherman, Figueredo, and Funder (2013) and Dunkel, Summerville,

Mathes, and Kesserling (2015), who independently created theory-derived slow Life History (SLH) templates of a widely used personality measurement instrument, the California Adult Q-Sort (CAQ: Block, 1978 (1961)). Dunkel et al. (2015) validated their version of the SLH CAQ template by showing that young adults whose CAQ profiles correlated more strongly with it were also characterized by reproductive behaviors indicative of a slow LHS (e.g. later age at sexual debut). As described in detail in section 2.1.4, published analyses (McCrae, Costa, & Busch, 1986) provide a means to score any CAQ profile on each of the FFM dimensions. The relationships, across individuals, between (1) the correlation between each individual's CAQ profile and the SLH CAQ template (hereafter, CAQ-based slow LHS) and (2) the individual's CAQ-generated score on each FFM dimension, permit inferences about the relationships between the FFM dimensions and Life History Speed. Scores on Conscientiousness, Agreeableness, and Emotional Stability are expected to be higher in individuals scoring higher in CAQ-based slow LHS. If Extraversion and Openness are mixed dimensions with respect to LHS (Del Giudice, 2012, 2014a), then they will be weakly related or unrelated to CAQ-based slow LHS. Analogous analyses using individual CAQ items that load on Extraversion and Openness can shed light on whether different facets of those traits are differentially related to LHS. Are Extraversion-loading items tapping interpersonal warmth (as distinct from assertiveness or excitement-seeking), and Openness items tapping intellect (as distinct from imagination), more likely to be positively associated with CAQ-based slow LHS?

As a second approach, in one of two studies I assess the relationships among (1) LHS and personality dimension measures derived from the CAQ (described above), (2) a self-report LHS measure (the Arizona Life History Battery [ALHB]: Figueredo, 2007), and (3) a self-report personality inventory based on the HEXACO personality model (Ashton & Lee, 2001, 2007).

Reasons for measuring the HEXACO dimensions rather than the FFM dimensions are described by Manson (2015) and are beyond the scope of this paper. The analyses reported in the present study afford tests of the validity of the three CAQ-measured FFM dimensions that have HEXACO counterparts: Extraversion, Openness, and Conscientiousness. HEXACO Agreeableness and Emotionality represent an alternative rotation of the personality space covered in the FFM by Agreeableness and Neuroticism (Ashton & Lee, 2001, 2007), so these two FFM dimensions cannot be validated by self-report in the present study. The self-report data also permit tests of the relationships between each HEXACO Extraversion and Openness facet and both the ALHB and CAQ-based slow LHS.

Finally, the self-report data enable the second goal of the proposed study, which is a preliminary attempt to examine the convergent validity of the ALHB and the SLH CAQ template as measures of Life History Strategy. How strongly associated are ALHB scores and CAQ-based slow LHS, and how is their relationship mediated by personality dimensions?

2. Study 1

Study 1 used periodic brief audio recordings from participants' daily lives as the basis for constructing CAQ profiles. Participants also completed a HEXACO personality and the ALHB.

2.1. Methods

2.1.1. Participants and audio recording collection procedure

Ninety-two students (55.4% female, $M \pm SD = 20.0 \pm 3.1$ years old), enrolled at a university in the western United States, were recruited via posted flyers and classroom announcements to participate in a study bearing the public title "Audio Sampling of Daily Life." Based on self-reported ethnic identity, 53.2% of the sample was Asian or Asian-American, 16.3% White, 12.0% Latino/a, 3.2% Middle Eastern, and 15.3% mixed or "other." The principal

study protocol employed the Electronically Activated Recorder (EAR: Mehl, Pennebaker, Crow, Dabbs, & Price, 2001; Mehl & Robbins, 2012). Instantiated as an app for the iPod Touch, the EAR generates periodic brief audio recordings (in this study, a 30-sec clip every 12.5 min) as participants go about their daily lives. Participants know the general sampling pattern, but not whether the app is recording at any particular time. Research shows that personality trait variation is detectable from EAR recordings (Mehl, Gosling, & Pennebaker, 2006). In the present study, participants were instructed to wear the iPod clipped to their belt or waistline whenever possible during their waking hours for a 72-hour period. No recordings were made between midnight and 0600. Participants were also instructed to keep an hourly diary briefly describing their general activities and whether or not they were wearing the iPod during that entire hour. Upon returning the iPod, participants were given the opportunity to privately review their audio clips and to delete any they wished, before researchers listened to them. Participants received a \$50 Amazon gift card as compensation. They were not informed of the specific hypotheses of the study until after all participants had completed participation.

2.1.2. Self-report measures

After returning the iPod and before receiving their compensation, participants were asked to complete, at their convenience, an online battery of self-report instruments. These included the Arizona Life History Battery (ALHB: Figueredo, 2007) and the HEXACO-60 (Ashton & Lee, 2009). The ALHB is a 199-item self-report instrument consisting of eight scales drawn from various original sources (Barrera, Sandler, & Ramsay, 1981; Brennan, Clark, & Shaver, 1998; Brim et al., 2000). Seven of the scales measure distinct aspects of Life History Strategy: Insight, Planning and Control; Relationships with Biological Parents; Family Contact and Support; Friends Contact and Support; General Altruism; Religiosity; and Experiences in Close

Relationships. The eighth ALHB scale, the Mini-K, contains 20 items tapping general features of all seven LHS facets. The eight indicators converge on a single multivariate latent construct, the *K-Factor* (Gladden et al., 2009; Wenner, Bianchi, Figueredo, Rushton, & Jacobs, 2013), which can be estimated as the mean of the z-scores of the seven scales excluding the Mini-K (Figueredo, 2007). Because the sample was drawn from an undergraduate population, I deleted from analyses the 8 items of the Altruism Toward Children subscale.

In the HEXACO-60 (Ashton & Lee, 2009), each HEXACO dimension (Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness and Openness) is tapped by 10 items, to which participants respond using a five-point scale. The two personality dimensions whose relationship to Life History Strategy is debated (Extraversion and Openness) are quite similar between the FFM and HEXACO structures, as is Conscientiousness (Ashton & Lee, 2007). Each HEXACO dimension is comprised of four facets (Ashton & Lee, 2007), each of which is tapped by 2-3 items of the HEXACO-60 (Ashton & Lee, 2009). The four Extraversion facets are Social Self-Esteem, Social Boldness, Sociability, and Liveliness. The four Openness facets are Aesthetic Appreciation, Inquisitiveness, Creativity, and Unconventionality. I calculated each facet score as the mean score across its constituent non-missing items. Each dimension score was then calculated as the mean across its four facet scores, and standardized.

2.1.3. California adult Q-sort (CAQ) rating

The California Adult Q-Sort, or Q-Set (CAQ: Block, 1978), modified for use by non-professionals by Bem and Funder (1978) consists of 100 statements describing a broad range of personality features, e.g. “Is sociable, gregarious; emphasizes being with others” and “Feels a lack of meaning in life.” Raters are required to sort each item into one of nine categories ranging

from “1 = *extremely uncharacteristic*” to “9 = *extremely characteristic*” with category 5 labeled as “*neither characteristic nor uncharacteristic*.” The number of items per category is pre-set, such that the two most extreme categories each contain five items, categories farther from the extremes contain progressively more items, and category 5 contains the most items (18). Thus, raters are constrained to arrange the items in a quasi-normal distribution.

Twenty-four raters, ignorant of the study’s hypotheses, were trained in the use of the CAQ and were instructed to generate CAQ profiles of participants based on their audio clips and hourly event diaries. To standardize the protocol, raters were instructed to listen to each audio clip no more than three times (if necessary to understand unclear speech) and not to listen again to any clip after listening to the entire set of each participant’s clips. Raters were not permitted to generate a CAQ profile if they recognized the voice of a participant or any of a participant’s interlocutors. The mean number of CAQ profiles generated per rater was 11.0 (SD = 7.4). My initial goal was to obtain three profiles for every participant. However, 13 of the 92 participants spoke languages other than English in >4 audio clips, necessitating the recruitment of raters fluent in those languages (Spanish, Mandarin, Cantonese, Korean, Vietnamese and Armenian). Thus, 84 participants were described by three raters, five participants by two raters, and three participants by one rater. For each participant, a profile was constructed by averaging the placement of each of the 100 CAQ items across the raters who described that participant.

2.1.4. Analysis

One use of the CAQ is to compare (i.e. correlate) participants’ CAQ profiles to a template designed to represent a psychological construct, e.g. primary psychopathy (Reise & Oliver, 1994). Two research groups (Dunkel et al., 2015; Sherman et al., 2013) have independently generated slow Life History (SLH) CAQ templates, which are quite similar,

correlating at $r = .86$ (Dunkel et al., 2015). In both versions of the SLH CAQ template, the most characteristic items include “Genuinely dependable person,” “Warmth, capacity for close relationships,” “Protective of those close to her/him,” “Moralistic,” and “Favors conservative values.” The items most uncharacteristic of a slow LHS (i.e. most characteristic of a fast LHS) include “Unpredictable in behavior/attitudes,” “Guileful, deceitful and manipulative,” “Rebellious, nonconforming,” “Unable to delay gratification,” and “Keeps people at a distance.” The correlation between each participant’s CAQ profile and the SLH CAQ template from Sherman et al. (2013) was calculated and then transformed using the Fisher r -to- z transformation. This will be referred to as a participant’s CAQ-based slow LHS score.

Based on data from the Baltimore Longitudinal Study of Aging (Shock et al., 1984), McCrae et al. (1986) describe a factor analysis of CAQ self-ratings and expert interview-based CAQ ratings that yielded five factors corresponding to the FFM dimensions. These factors demonstrated convergent and discriminative validity with respect to self-, peer-, and spouse-ratings using FFM-based instruments. Seventy-eight of the 100 CAQ items loaded on at least one of the five factors, 18 items loaded on two or more factors, and one item loaded on three factors. I used McCrae et al.’s (1986) factor loadings, and followed their method of calculating, for each CAQ profile, a unit-weighted score for each FFM dimension. This calculation consisted of adding the placements (ranging from “1 = *extremely uncharacteristic*” to “9 = *extremely characteristic*”) of the CAQ items that loaded on each FFM factor at $>.30$, and subtracting the placements of the CAQ items that loaded on that factor at $<-.30$. As examples, the items with the highest and lowest loadings, respectively, on Extraversion were “Is a talkative individual” and “Emotionally bland; flattened affect.” The items with the highest and lowest loadings, respectively, on Openness were “Values intellectual matters” and “Favors conservative values”

When an item loaded on two or more factors, it was scored only for the factor on which it had the highest loading. To maintain consistency with McCrae et al's (1986) presentation, I scored individuals with respect to Neuroticism (the inverse of Emotional Stability).

I carried out multiple regression analyses in which CAQ-based slow LHS was the dependent variable, and unit-weighted scores on the five FFM dimensions were the predictor variables. I planned to conduct mediation analyses to assess each CAQ-generated FFM dimension's mediating effect on the relationship between the ALHB-derived K-Factor and CAQ-based slow LHS. However, this relationship failed to attain statistical significance (Table 1). As an alternative, I improvised analytical procedures, described in Section 2.2.6, to assess the influences of Extraversion, Openness and Conscientiousness on the relationship between the two LHS measures.

2.2. Results

Data from Study 1 may be found online at <http://dx.doi.org/10.5061/dryad.03f4f>

2.2.1. Descriptive statistics

Participants deleted an average of 1.1% of their audio clips ($SD = 2.4\%$, median = 0, range = 0-15.0%). Of the 84 participants whose CAQ profiles were prepared by three raters, one showed negative inter-rater reliability (Cronbach's $\alpha = -.09$), so this participant's data were excluded from further analyses, yielding a sample size of 91. Among the remaining 83 participants, inter-rater reliability of the CAQ profiles was acceptable (Cronbach's α , $M \pm SD = .67 \pm .14$, median = .69, range = .29-.90). For the five participants rated by two raters, the average correlation between raters was .46 across the 100 CAQ items.

Table 1 shows the zero-order correlations among the CAQ-generated FFM dimensions, CAQ-based slow LHS, the ALHB-derived *K-Factor*, and the HEXACO dimensions. The internal

reliabilities of the measures were acceptable ($>.67$), with the exception of CAQ-generated Openness. Removing three CAQ items from the scale (007, “Favors conservative values”; 041, “Makes moral judgments”; and 062, “Rebellious and nonconforming”) increased alpha from .33 to .57. Correlations of both the original and reliability-adjusted versions of Openness with the other measures are shown. Notably, ALHB scores were not significantly related to CAQ-based LHS ($p = .11$) or to any of the CAQ-generated FFM scores except for Neuroticism (negatively). Among the HEXACO dimensions, ALHB was positively correlated with Extraversion, Agreeableness, and Conscientiousness. Note that, in contrast, the zero-order correlation between CAQ-based slow LHS and CAQ-based Extraversion showed a non-significant trend ($p = .07$) toward a negative association.

2.2.2. Validation of CAQ-based FFM scores

I ran multiple regressions, calculating standardized beta coefficients, in which unit-weighted CAQ-based FFM score was the dependent variable, and the six self-reported HEXACO dimension scores were the independent variables. Of the six HEXACO factors, only Extraversion significantly predicted CAQ-based Extraversion ($\beta = .33, n = 91, p = .003$), and only Openness significantly predicted CAQ-based Openness ($\beta = .28, p = .011$). CAQ Conscientiousness was positively predicted by HEXACO Conscientiousness ($\beta = .25, p = .024$) and negatively predicted by HEXACO Extraversion ($\beta = -.26, p = .018$).

2.2.3. CAQ-based FFM scores and CAQ-based slow LHS

Table 2 shows the results of regressing CAQ-based slow LHS on the CAQ-generated FFM scores. People whose CAQ profile more closely resembled the SLH CAQ template were higher in Conscientiousness and Agreeableness, and lower in Neuroticism and Openness, than people whose CAQ profile differed more from the SLH CAQ template. Extraversion was

unrelated to CAQ-based slow LHS. Substituting the reliability-adjusted Openness score for the score based on all Openness-loading items eliminated the relationship between CAQ-based slow LHS and Openness, while leaving its relationship with the other four FFM factors qualitatively unchanged. With respect to CAQ-based Openness, the regression results differ from the bivariate correlations shown in Table 1 (which indicate no relationship between CAQ-based slow LHS and Openness, and a positive relationship between CAQ-based slow LHS and reliability-adjusted Openness) because only the regression analysis isolates the unique contribution of Openness to LHS. This contribution is obscured, in the bivariate correlations, by the negative relationship of CAQ-based Openness to CAQ-based Neuroticism, and the positive relationships of CAQ-based Openness to Agreeableness and CAQ-based reliability-adjusted Openness to Conscientiousness.

2.2.4. CAQ Extraversion- and Openness-loading items and CAQ-based slow LHS

The designated columns of tables 3 and 4 show, for Extraversion and Openness respectively, Study 1's correlations between CAQ-based slow LHS and each of the CAQ items that loads on that dimension. For positively loading items, positive correlations contribute to a positive relationship between the overall FFM dimension and slow LH, while negative correlations contribute to a negative relationship between the overall FFM dimension and slow LH. The reverse is true for negatively loading items. For example, item 099, "Is self-dramatizing, theatrical," which loads positively on Extraversion, was negatively correlated with CAQ-based LHS, such that it contributed to reducing the association between overall Extraversion and slow LH.

2.2.5. HEXACO Extraversion and Openness facets and Life History measures

Table 5 shows, for each HEXACO Extraversion and Openness facet, its scale reliability and its correlations with the ALHB and CAQ-based slow LHS. It also shows the unique relationship of each facet with the ALHB and CAQ-based slow LHS after controlling for the other three facets of its dimension, as obtained by regressing the facet score on the other three facet scores and computing the residuals. In general, this analysis showed few differences, among the facets within each dimension, in their directions or magnitudes as LH indicators.

2.2.6. *ALHB, personality dimensions, and CAQ-based slow LHS*

Because ALHB and CAQ-based slow LHS were not significantly related (Table 1), it was impossible to use mediation analysis to examine how each of the three personality dimensions common to the HEXACO and FFM models (Conscientiousness, Extraversion, and Openness) mediated the relationship between the two LHS measures. As a substitute, I created modified versions of ALHB and CAQ-based slow LHS scores from which one personality dimension's influence was removed. Correlations between these modified measures can then shed light on how much of their shared variation is accounted for by each personality dimension. The modified ALHB measure was the residual of the regression of ALHB score on the relevant HEXACO personality score. The modified CAQ-based slow LHS score was the correlation (Fisher r -to- z transformed) between the individual's CAQ profile and the SLH CAQ template after removing from analysis the CAQ items that load on the relevant FFM dimension (from McCrae et al., 1986). Using these methods to create Conscientiousness-controlled versions of the ALHB and CAQ-based slow LHS reduced the correlation between the two LH measures from .17 to .03. In contrast, the correlation between Extraversion-controlled ALHB and Extraversion-controlled CAQ-based slow LHS increased to .26 ($p = .014$). The correlation between Openness-controlled ALHB and Openness-controlled CAQ-based slow LHS was .13

after excluding, from the CAQ profiles, all the items that load on Openness, and .14 after excluding only the items that comprised reliability-adjusted CAQ Openness (see Section 2.2.1).

3. Study 2

Study 2 differed from Study 1 in (1) its participant source, (2) the observations on which CAQ profiles were based, and (2) not including self-report personality or LHS measures.

3.1. Methods

3.1.1. Participants and CAQ profile sources

A sample of CAQ profiles was obtained from the Block and Block 30-year longitudinal study (Block & Block, 2006b), from which data are available from the online Murray Research Archive (Block & Block, 2006a). This is the same data set that Dunkel et al. (2015) used to validate the SLH CAQ template with data on reproductive behavior (see Sections 1.0 and 2.1.4). Participants were recruited from two nursery schools in Berkeley, California, in 1969, and were asked to participate in a wide range of observational, experimental, and self-report data collection protocols periodically until age 32. This sample's ethnic composition is described as approximately two-thirds White, one-quarter African-American, and one-twelfth Asian (Block & Block, 2006a). Among the data collection protocols were CAQ profiles based on ratings by multiple examiners at ages 14, 18, and 23. Of the 128 individuals originally recruited, 102 (51% female) provided data for the examiner-based CAQ profiles at age 23, which I used in this study.

3.1.2. Analysis

As in Study 1, CAQ-based Slow LHS was calculated as the correlation (r -to- z transformed) between an individual's CAQ profile and the SLH CAQ template (Sherman et al., 2013), and CAQ-generated FFM dimension scores were calculated based on the findings of McCrae et al. (1986).

3.2. Results

Table 6 shows the bivariate correlations among the CAQ-generated FFM dimensions and CAQ-based slow LHS, along with scale reliabilities. Table 7 shows the results of regressing CAQ-based slow LHS on the CAQ-generated FFM scores. As in Study 1, people whose CAQ profile more closely resembled the SLH CAQ template were higher in Conscientiousness and Agreeableness, and lower in Neuroticism and Openness, than people whose CAQ profile differed more from the SLH CAQ template. Unlike in Study 1, Openness was uncorrelated with the other FFM dimensions. This may explain why Openness was uncorrelated, rather than positively correlated as in Study 1, with CAQ-based slow LHS. Extraversion was unrelated to CAQ-based slow LHS.

The designated columns of tables 3 and 4 show, for Extraversion and Openness respectively, Study 2's correlations between CAQ-based slow LHS and each of the CAQ items that loads on that dimension. Combining the positively and negatively loading items, the Study 1 and Study 2 samples were significantly similar to each other with respect to these correlations (Fisher r -to- z transformed) for both Extraversion ($r = .55$, $n = 16$ items, $p = .028$) and Openness ($r = .70$, $n = 11$ items, $p = .016$).

4. General Discussion

This study examined relationships between Life History Strategy and the major dimensions of personality. This question is central to the broader enterprise of using LH Theory to explain and predict individual differences in humans, and it has inspired a large empirical literature, but some controversies remain. In both studies, unsurprisingly, individuals whose California Adult Q-Sort profile more closely resembled the slow Life History CAQ template (Dunkel et al., 2015; Sherman et al., 2013) were more Conscientious, Agreeable and Emotionally

Stable than those whose CAQ profile differed more from the SLH CAQ template. Extraversion and Openness, however, appear to be mixed dimensions comprising both slow and fast LH facets, as proposed by Del Giudice (2012, 2014a). In both studies, Extraversion was unrelated to CAQ-based slow LHS after controlling for the effects of the other FFM dimensions. Surprisingly, Openness was negatively related to CAQ-based slow LHS (i.e. it appeared to be a fast Life History indicator) in Study 2. Results from Study 1 are more difficult to interpret, because CAQ Openness as established by McCrae et al. (1986) showed poor inter-item reliability, but Openness was either negatively related or unrelated to CAQ-based slow LHS.

At the level of FFM factors' relationships to LHS, results from the two studies did not differ greatly (Tables 2 and 7). This finding is noteworthy because, although both samples consisted of young adults residing in the United States, they differed in important respects. The Study 1 participants were university students, a slight majority of whom were Asian or Asian-American, and almost all of whom were born in the mid-1990s. In contrast, Block and Block (2006a, 2006b) studied a community sample consisting mostly of Whites and African-Americans, of whom all were born in the mid-1960s. Furthermore, the two studies' CAQ profiles were generated from different kinds of observations: periodic brief audio recordings of daily life in Study 1, and clinical interviews and other laboratory-based assessment procedures in Study 2 (Block & Robins, 1993).

However, at the level of individual CAQ items (Tables 3-4), results from the two studies differed somewhat, as discussed below, although they were significantly similar overall. The differences might result from differences between the two studies' assessment methods or populations. With respect to assessment methods, for peer raters using only audio recordings as stimuli (Study 1), participants' spontaneous verbal behavior presumably had greater relative

salience than for clinicians conducting in-person interviews and employing standardized assessment tools (Study 2). Lacking access to other sources of information, Study 1 raters, compared to Study 2 raters, may have perceived participants differently with respect to the CAQ items that are most easily judged purely from spontaneous verbal behavior.

In both studies, individuals pursuing a slower LHS were perceived as persistent (CAQ item 030), indicative of high Extraversion, but also excessively self-controlled (item 025) and averse to self-dramatizing (item 099), indicative of low Extraversion. In Study 2, only, slow LH Strategists were sociable and socially skilled (items 029, 054, 092, 095, 098 and 048), indicative of high Extraversion, but submissive (item 014), indicative of low Extraversion. These findings support Del Giudice's (2012, 2014a) hypothesis about the relationships of the various Extraversion facets to LHS. However, in Study 1, these associations were not found, and one additional item (004, talkativeness) was associated (negatively) with CAQ-based slow LHS. Talkativeness is one of the CAQ items that may have been perceived differently by Study 1 raters than by Study 2 raters.

With respect to Openness-loading CAQ items (Table 4), in both studies, individuals pursuing a slow LHS were more intellectually inclined and curious (items 003 and 051), indicative of high Openness, but also more conformist and moralistic (items 062, 007, and 041), indicative of low Openness. Two notable differences are apparent between Study 1 and Study 2. First, in Study 1, unlike in Study 2, CAQ-based Openness, as established by McCrae et al. (1986), showed poor inter-item reliability. The three items responsible for this (007, "Favors conservative values"; 041, "Makes moral judgments"; and 062, "Rebellious and nonconforming") were the items driving the negative relationship between CAQ-based Openness and CAQ-based slow LHS; when they were removed from the Openness scale, this relationship

vanished. Interestingly, items 007 and 041 are also, like talkativeness, items that might be perceived differently by Study 1 raters than by Study 2 raters. In Study 2, the inter-item reliability of Openness was the lowest of the FFM dimensions, but still acceptably high, as is generally found in FFM self-report inventories (Viswesvaran & Ones, 2000). Second, in Study 1, individuals pursuing a slower LH were less influenced by social pressures (item 063), whereas the opposite was true in Study 2. This might reflect differences between the social pressures faced by college students and those faced by the more heterogeneous and slightly older population from which the Study 2 participants were drawn. In general, however, the observed patterns support Del Giudice's (2012, 2014a) hypothesis about the relationships of the various Openness facets to LHS.

In contrast, the Study 1 participants' scores on the self-report HEXACO Extraversion and Openness facet scores (Table 5) provided no support for hypothesized differentiated relationships between these facets and LHS. In general, this could be partly attributable to differences between the HEXACO and CAQ measurement methods (self-report vs. observer-report). With respect to Extraversion specifically, it may be partly a result of differences between this dimension's FFM facets and its HEXACO facets. In contrast to FFM Extraversion (Costa & McCrae, 1995), HEXACO Extraversion lacks an Excitement Seeking facet (Ashton & Lee, 2001, 2007). The Assertiveness facet of FFM Extraversion is roughly equivalent to the Social Boldness facet of HEXACO Extraversion. However, none of the items tapping Social Boldness in the HEXACO-60 (or the full HEXACO-PI: Lee & Ashton, 2004) refer directly to dominating others, in contrast to, for example, all five positively-keyed items in the IPIP NEO Assertiveness (E3) scale (<http://ipip.ori.org/newNEOKey.htm#Assertiveness>). Among the HEXACO Openness facets, only Creativity was significantly related (positively) to ALHB, and only Aesthetic

Appreciation was significantly related (also positively) to CAQ-based slow LHS. None of the Openness facets showed even a trending negative association with either LH measure. Indeed, the zero-order correlation between HEXACO Openness and CAQ-based slow LHS was actually significantly positive, in contrast to the significantly negative relationship, in both participant samples, between CAQ-generated Openness and CAQ-based slow LHS revealed by multivariate analyses. These seemingly inconsistent results may be attributable to a sample-specific characteristic of the Audio Sampling participants, specifically an unusually strong positive correlation (.21) between HEXACO Openness and Conscientiousness (compare Ashton & Lee, 2009; Lee & Ashton, 2004; Lee, Ogunfowora, & Ashton, 2005).

Surprisingly, the ALHB and CAQ-based slow LHS (i.e. the correlation between an individual's CAQ profile and the SLH CAQ template) were not significantly correlated, despite being derived from the same theoretical conceptualization of Life History Speed variation as a source of individual differences (Dunkel et al., 2015; Figueredo et al., 2004, 2007; Sherman et al., 2013). This result might reflect differences between the perspectives of self-report (the ALHB) and other-rating (the CAQ-based slow LHS scores). In a series of studies, Dunkel et al. (2016) found somewhat higher, though still modest ($r = .16-.27$), correlations between self-report LH instruments and CAQ-based peer-ratings of LHS when raters' only information about target individuals consisted of brief videotaped conversations or transcripts of answers to questions about major life events. Additionally, it is possible that peculiarities of my Audio Sampling participant sample are responsible for the non-significant relationship between ALHB and CAQ-based slow LHS in the present study. Further research is necessary to explore the convergent validity of these two measures. However, the different relationships between personality dimensions and the variation shared by the two LHS instruments suggest that they measure

constructs that overlap only partially. Controlling for Conscientiousness attenuated the correlation between them almost completely, whereas controlling for Extraversion increased the correlation. Some CAQ items that load positively on Extraversion were negatively related to CAQ-based slow LHS, while some CAQ items that load negatively on Extraversion were positively related to CAQ-based slow LHS (Table 3). In contrast, many of the ALHB items tap high-Extraversion content, whereas few to none of them tap low-Extraversion content. Specifically, the ALHB's Friends Contact and Support, Family Contact and Support, and Altruism scales partly tap variation in the enjoyment of social situations, while the Insight, Planning, and Control scale partly taps a propensity toward positive affect.

Although this study did not construct measures of the General Factor of Personality (Musek, 2007) or other higher-order personality factors, its results are relevant to the question of the GFP's use as a Life History speed indicator. Observed associations between the GFP and LHS are strong (Dunkel & Decker, 2010; Dunkel, Kim, & Papini, 2012; Figueredo et al., 2007; Figueredo et al., 2014) but a considerable portion of LHS variation is unexplained by the GFP, such that the GFP's utility as an LHS indicator remains controversial (Del Giudice, 2014b). At a level of aggregation between the GFP and the FFM dimensions, some evidence supports a "Big Two" structure (Digman, 1997) consisting of Stability (with positive loadings of Agreeableness, Conscientiousness and Emotional Stability, the dimensions strongly related to LHS) and Plasticity (with positive loadings of Extraversion and Openness, the dimensions with equivocal relationships to LHS in this study). These two dimensions are positively correlated with each other, but correlated in opposite directions with conformity (Stability positively and Plasticity negatively; DeYoung, Peterson, & Higgins, 2002), a narrow trait which in the present study was largely responsible for the null or negative relationship between Openness and slow LHS.

Although beyond the scope of this paper, analyses of relationships between LHS and the Big Two, based on CAQ ratings, would be illuminating. More generally, additional research is needed to determine both the broader and the narrower personality dimensions, as well as individual differences outside the realm of personality, that fit within the nomological network surrounding psychometric assessments of human LHS (Figueredo et al., 2014).

One limitation of this study is that the Study 1 participants did not provide any data on biometric LH variables such as age at puberty (Copping, Campbell, & Muncer, 2014; but see Figueredo et al., 2015). A second limitation is that, although the CAQ has been adapted (Dunkel et al., 2015; Sherman et al., 2013) to measure an evolutionary construct, Life History strategy, the instrument itself originated in psychodynamically oriented psychiatry (Block, 1978). Unsurprisingly, the content of many of the items is tangential to evolutionary questions, whereas several behavioral domains central to evolutionary social science (e.g. kin bias) are absent from the CAQ item set. The Q-sort method, in general, is a more powerful psychometric tool than the more commonly used Likert-based instruments (Block, 1978; Sherman, Nave, & Funder, 2010). A personality Q-set based explicitly on evolutionary concepts would be a valuable contribution.

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independent assessments based on personality and cognitive Life, Observational, Test, and Self-report (LOTS) measures.

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8. ALHB	-.22*	.10	.09	.15	.17	.07	.17	.68						
9. HEXACO H	-.00	-.17	.14	.24*	-.07	.12	.02	.08	.75					
10. HEXACO E	.06	.14	.06	.04	.25*	.03	.13	.02	-	.67				
11. HEXACO X	-.11	.30**	.09	.01	-.00	-.20	-.14	.47**	-	-	.82			
12. HEXACO A	.06	.06	-	-.05	.00	-.08	-.03	.22*	.0	-	.14	.84		
13. HEXACO C	-.25*	.05	.02	.09	.29**	.21*	.31*	.49**	.1	-	.25	.1	.70	
14. HEXACO O	-	-.05	.25	.30**	.23*	.11	.23*	.18	.1	-	.17	.0	.21	.71
	.27**		*						0	.24		6	*	1
										*				

Notes: CAQ-based dimensions: N = Neuroticism; E = Extraversion; O = Openness; reliability-adjusted CAQ Openness omits CAQ items 007, 041, and 062; A = Agreeableness; C = Conscientiousness. HEXACO dimensions: H = Honesty-Humility; E = Emotionality; X = Extraversion; A = Agreeableness; C = Conscientiousness; O = Openness. Bold-faced values on the diagonal indicate inter-item scale reliability (Cronbach's alpha).

* $p < .05$

** $p < .01$

*** $p < .001$

Table 2

Study 1: multiple regression of CAQ-based Slow LHS on unit-weighted CAQ-based FFM dimension scores.

FFM factor	Unstandardized $\beta \pm SE$	Standardized β	p
Neuroticism	-0.005 $\pm$ 0.0011	-0.276	<0.001
Extraversion	-0.0003 $\pm$ 0.0009	-0.023	0.71
Openness	-0.005 $\pm$ 0.0023	-0.124	0.02
Agreeableness	0.009 $\pm$ 0.0016	0.357	<0.001
Conscientiousness	0.014 $\pm$ 0.0016	0.560	<0.001

Note: substituting reliability-adjusted Openness changes the standardized betas as follows:

Neuroticism, -0.253, $p < 0.001$; Extraversion, -0.038, $p = 0.541$; Openness, -0.056, $p = 0.393$; Agreeableness, 0.360, $p < 0.001$; Conscientiousness, 0.576, $p < 0.001$.

Table 3

Correlations from both studies between Extraversion-loading items and participants' CAQ profiles' correlations with the SLH template (CAQ-based Slow LHS).

Positively loading items		Study	
Item	Text	1. Audio	2. Block &
		sampling	Block
		(<i>n</i> = 91)	(<i>n</i> = 102)
004	Is a talkative person	-0.24*	0.08
015	Skilled in social techniques of imaginative play	-0.16	0.17
018	Initiates humor	-0.03	0.16

020	Behaves and acts quickly	-0.14	0.04
029	Is turned to for advice and reassurance	0.08	0.68***
054	Is sociable, gregarious	-0.14	0.39***
092	Has social poise and presence	-0.00	0.63***
095	Gives advice; concerned with others' business	0.08	0.34***
098	Is verbally fluent	0.11	0.57***
099	Is self-dramatizing, theatrical	-0.62***	-0.44***

Negatively loading items

Item	Text		
014	Genuinely submissive	0.08	0.28**
025	Has excessive self-control	0.38***	0.55***
030	Gives up in the face of frustration or adversity	-0.40***	-0.65***

048	Keeps people at a distance	0.04	-0.52***
079	Tends to ruminate	0.07	-0.42***
097	Is an unemotional person	0.22*	0.04

* $p < .05$

** $p < .01$

*** $p < .001$

Table 4

Correlations from both studies between Openness-loading items and participants' CAQ profiles' correlations with the SLH template (CAQ-based Slow LHS).

Positively loading items		Study	
Item	Text	1. Audio sampling (<i>n</i> = 91)	2. Block & Block (<i>n</i> = 102)
003	Has a wide range of interests	0.22*	0.50***
016	Is introspective; thinks about self	0.31**	0.28**
039	Thinks about ideas in unusual ways	0.03	-0.61***

051	Places high value on intellectual matters	0.58***	0.56***
062	Tends to be rebellious and nonconforming	-0.56***	-0.77***
066	Enjoys aesthetic impressions; aesthetically sensitive	0.09	0.14
<hr/>			
Negatively loading items			
<hr/>			
Item	Text		
<hr/>			
Favors conservative values in a variety of areas			
007		0.47***	0.55***
009	Is uncomfortable with uncertainty and complexity	-0.16	-0.19
041	Makes moral judgments	0.48***	0.25*
063	Is influenced by social pressures (e.g. "popularity")	-0.46***	0.24*
093	Behaves in a gender-typical style	-0.15	-0.01

Note: Italicized items were removed from the Study 1 Openness scale to create a reliability-adjusted scale.

* $p < .05$

** $p < .01$

*** $p < .001$

Table 5

Study 1: correlations between HEXACO Extraversion and Openness facets and ALHB and CAQ-based Slow LHS ($n = 91$).

		Correlation with facet score	Correlation with facet score residualized on the remainder of the factor		
	Scale reliability (α)	ALHB	CAQ-based Slow LHS	ALHB	CAQ-based Slow LHS
Extraversion					
Social self-esteem	0.68	0.42***	-0.11	0.18	0.01
Social boldness	0.75	0.24*	-0.15	-0.08	-0.14
Sociability	0.59	0.38***	-0.03	0.21*	0.11
Liveliness	0.55	0.42***	-0.16	0.13	-0.12

Openness

Aesthetic	0.59	0.07	0.25*	-0.03	0.18
appreciation					
Inquisitiveness	0.56	0.14	0.16	0.12	0.04
Creativity	0.71	0.23*	0.10	0.22*	0.03
Unconventionality	0.53	0.17	0.12	-0.06	0.03

* $p < .05$

*** $p < .001$

Table 6

Study 2: correlations among California Q-Sort (CAQ) generated unit-weighted FFM scores and CAQ-based Slow LHS ($n = 102$).

	1.	2.	3.	4.	5.	6.
1. CAQ N	.93					
2. CAQ E	-.63***	.88				
3. CAQ O	-.08	.11	.83			
4. CAQ A	-.52***	.22*	.01	.91		
5. CAQ C	-.58***	.12	.08	.51***	.84	
6. CAQ-based Slow LHS	-.76***	.32***	-.14	.74***	.86***	N.A.

Note: Bold-faced values on the diagonal indicate inter-item scale reliability (Cronbach's alpha).

* $p < .05$

*** $p < .001$

Table 7

Study 2: multiple regression of CAQ-based Slow LHS on unit-weighted CAQ-based FFM dimension scores.

FFM factor	Unstandardized $\beta \pm SE$	Standardized β	<i>p</i>
Neuroticism	-0.004 $\pm$ 0.0005	-0.282	<0.001
Extraversion	0.001 $\pm$ 0.0007	0.036	0.22
Openness	-0.007 $\pm$ 0.0007	-0.214	<0.001
Agreeableness	0.007 $\pm$ 0.0006	0.298	<0.001
Conscientiousness	0.018 $\pm$ 0.0009	0.559	<0.001