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ORIGINAL PAPER

Using the California Q-sort Measure of Life History Strategy to Predict Sexual Behavioral Outcomes

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Abstract The validity of the California Q-set measure of life history (LH) strategy was examined by conducting secondary analyses on longitudinal data that included the Q-sort measure of LH strategy at multiple ages (base year N = 106) and six measures of reproductive behavior. LH strategy Q-sort ratings showed stability from ages 14–23. Additionally, the ratings were found to be good prospective and age concurrent predictors of six reproductive behaviors. LH strategy as rated at age 14 was found to be a significant predictor of age of sexual debut, number of sexual partners, frequency of intercourse, number of abortions, age at birth of first child, and likelihood for having contracted venereal disease as measured up to age 32. Future research should test the further utility of the measure focusing on ways to reduce its cumbersomeness without reducing its ability to predict behavioral outcomes.

Keywords Q-sort · Life history theory · Longitudinal · Measurement

Introduction

Life history (LH) theory began as a way to explain the selection of reproductive strategies given differing ecological constraints. These LH strategies are such that a large number of life course variables (e.g., length of lifespan, litter size, parental investment) cohere, forming a LH continuum representing differences in LH strategy. At one pole of the continuum are species that possess characteristics that reflect a fast LH strategy. These species tend to have shorter lifespans and take a quantity approach to reproduction (e.g., large litter size) with little parental investment. The slow LH strategy is at the other end of the continuum. Species at this pole tend to have longer lifespans and take a quality approach to reproduction; they have fewer offspring and invest heavily in them.

Pianka (1970) highlighted the LH differences between insects and vertebrates, subsequently leading Promislow and Harvey (1990) to analyze differences within vertebrates. While humans fall much closer to the slow end of the LH continuum, Rushton (1985) went a step further by focusing on differences in LH strategies between human groups, followed by even more molecular analyses of individual differences in LH strategy (e.g., Bogaert & Rushton, 1989; Figueredo et al., 2005) and their development (e.g., Belsky, Steinberg, & Draper, 1991; Chisholm, 1993; Ellis et al., 2003; Geronimus, 1996).

Following differences between species LH strategies, individual LH strategies can largely be seen as different reproductive strategies with variance representing the degree to which an individual takes a quality or quantity path towards reproduction. A fast LH strategy is marked by the characteristics of a quantity approach with early maturation, early sexual initiation, more frequent and variable reproductive behaviors, earlier reproduction, and less intensive parental investment. A slow LH strategy is marked by the characteristics of a quality approach with delayed maturation, late sexual initiation, more restrictive reproductive behaviors, resulting in later reproduction yet higher parental investment. These individual differences in LH strategy are increasingly used as an explanatory framework by which to understand a variety of other specific behaviors including, but not limited to, those related to health (Hill & Chow, 2002), economic decision making (White, Li, Grikevicius, Neuberg, & Kendrick, 2013), crime (Dunkel, Mathes, & Beaver, 2013), and sexual coercion (Gladden, Sisco, & Figueredo, 2008).

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The study of LH theory as applied to individual differences has progressed rapidly due in part to the development of easy to administer self-report paper-and-pencil measures. These measures include the Arizona Life History Battery and its more popular truncated version, the Mini-*K* (Figueredo et al., 2006), the High-*K* Strategy Scale (Giosan, 2006), and an assortment of proxy measures, such as future time perspective (e.g., Kruger, Reischl, & Zimmerman, 2008). Given that these measures are all self-report, they can be conveniently administered, but include the shortcomings inherent in all self-report measures (e.g., response bias). This issue is not limited to the study of LH strategy; increased reliance upon self-report measures and the issues that arise from this increased use has been identified as an important trend in the field of psychology, with the recommendation of the development and increased integration of behavioral based measures (Baumeister, Vohs, & Funder, 2007). This recommendation is buttressed by at least three findings, one general to the measurement of individual differences, one specific to LH theory, and, even more specifically, one associated with the measurement of LH theory.

The first finding is that behavioral based measures have been shown to have greater predictive power in comparison to self-report measures (Connelly & Ones, 2010; Dunkel, 2013). Second, Figueredo and Wolf (2009) and Wolf and Figueredo (2011) found evidence for assortative mating based on LH strategy, with assortative mating increasing as LH strategy slows. This means that slow LH individuals are able to identify other slow LH individuals and, as a result, are more likely to become romantically involved with each other. This suggests that an individual's LH strategy is able to be assessed informally by possible mates with some degree of accuracy. Third in a recent analysis of the HKSS, Copping, Campbell, and Muncer (2014) uncovered factor structure and validity problems. The HKSS was found to be a poor predictor of reproductive behaviors associated with LH strategy leading Copping et al. to call for the need of LH strategy measures to be validated by comparing scores with objective measures of LH strategy such as age of sexual debut and number of sexual partners.

To summarize, all of the established LH strategy measures are self-report; none are behaviorally based and this presents certain limitations. However, in a recent article, Sherman, Figueredo, and Finder (2013) reported on efforts to fill this void with a behaviorally based measure of LH strategy using the California Adult Q-set (CAQ) (Block, 1978). The CAQ is a variety of 100 short statements describing aspects of an individual's disposition (e.g., has a wide range of interests, tends to be self-defensive, initiates humor). The Q-set items are designed to be Q-sorted, that is, arranged in piles based on the degree to which the statements describe a concept or an individual. Often these sorts are arranged in a normal distribution with items that are quite non-descriptive or quite descriptive of the target placed at the far left or right columns.

A common method for scoring Q-sorts is the template or prototype approach (Block, 1961). In this approach, experts arrange the Q-set to describe a prototype and then individual's sorts are correlated with the resulting template. A recent example is seen in the work of Shedler and Westen (2007). They developed a Q-set with 200 items that were Q-sorted by psychiatrists and clinical psychologists to represent various personality disorders (Westen & Shedler, 1999a). These templates or diagnostic prototypes can used as a tool for diagnosing personality disorders by correlating an individual's sort with the template (Westen & Shelder, 1999b). A high correlation between an individual's sort and the template for a specific disorder warrants a diagnosis.

Sherman et al. (2013) used this template approach. They created a LH strategy Q-sort template by having six experts in LH theory sort the CAQ using the Q-sort method with the instructions to sort items according to the item's representativeness of LH strategy. Raters were instructed to place items most representative of a slow LH strategy at one pole, items representative of a fast LH strategy at the other pole, and items less descriptive of LH strategy in the middle. There were nine piles in total and they were arranged in a normal distribution. An acceptable level of inter-rater agreement was found ($r = .58$).

A composite CAQ template for LH strategy was then used to analyze archival data from the Riverside Accuracy Project Phases I and II (RAP I and RAP II) and the Riverside Situation Project (RSP). Sherman et al. (2013) found an impressive set of associations between the CAQ measure of LH strategy derived from independent raters, who based their ratings on video recordings of the participants interactions. A slow LH strategy was associated with more agreeable (even timid) social behaviors, a distinct set of word choices when speech was analyzed (a greater variety of words, more measured and less emotional speech; and, most interestingly, less focus on the topics of sex and death) and daily behaviors that reflected ambition and responsibility.

Purpose of the Current Study

While there are several measures of LH strategy from which to choose, there is a void of behaviorally based and dispositional measures. The results of Sherman et al. (2013) suggest that the CAQ measure can fill this void by being a behaviorally based, observer judged, measure of LH strategy. However, the criterion measures in the study were at most tangentially (e.g., sex as a topic of speech) associated with core LH characteristics (e.g., reproductive behaviors). The purpose of the current investigation was to follow-up on the promising results of Sherman et al. by testing the ability of the CAQ measure of LH strategy to predict reproductive behaviors.

Method

Participants

The Block and Block (2006a) 30-year longitudinal study was utilized. Block and Block used a multi-trait, multi-method approach to measure various aspects of development by administering a large battery of measures from age 3 to 32 years.

The data and documentation files were obtained electronically from the Murray Research Archive (Block & Block, 2006b). Documentation files described the sample as roughly two-thirds white, one-quarter black, and one-twelfth Asian, residing in an urban setting. Participants were recruited from two preschools in Berkeley, California. The base year data for the current analyses was when the participants were 14 years of age and included 52 males and 54 females. Seventy-one of the participants were White, 27 were Black, five were Asian, and three were categorized as "other." At age 32, 74 participants described their sexual orientation as heterosexual, six described their sexual orientation as bisexual, and two described their sexual orientation as homosexual.

The sample was described as heterogeneous with regards to socioeconomic status (Block & Block, 2006a), but with slight overrepresentation of the middle class (Funder & Block, 1989). The data file included Duncan's (1961) Socioeconomic Index scores for both the participant's father and mother assessed when the participant was 14 years of age. For the sake of analysis, these two scores were transformed into *z*-scores and summed to make a composite indicator of socioeconomic status.

Measures

While the development of a Q-sort measure of LH strategy using the CAQ by Sherman et al. (2013) was in progress, following the same template methodology our research team was also developing a measure of LH strategy from the CAQ. Five raters, including the first three authors and two psychology graduate students, sorted the CAQ items along the fast-slow LH continuum. The inter-rater correlations among raters ranged from $r = .59$ to $r = .79$ (note this was a similar level of inter-rater agreement found by Sherman et al., 2013). A composite measure with each rater's ratings weighted equally was then created.

The CAQ measure of LH strategy from the other research team was then downloaded from http://psy2.fau.edu/~shermanr/Pubs.html; this allowed for a comparison of measures between the two teams. The correlation between our composite and the composite from the other research team was $r = .86$. Given the robust size of this correlation, the scores of the two teams were used to compute a third total, a composite equally weighting the two CAQ measures from each research team. The 10 most descriptive items for both the slow and fast poles of LH strategy template are shown in the Appendix.

Q-sort LH measures, derived by using the methods on the CAQ sorts as described previously, were available for ages 14, 18, and 23. At age 14, four examiners (i.e., test administrators) independently Q-sorted each participant using the CAQ. These four sorts were then aggregated to form a composite. The same procedure was performed at age 18 (with different examiners than at age 14) with two additional Q-sorts from interviewers of the participants added to the composite. Two Q-sort measures of LH strategy were also available from the age 23 wave of data collection. One measure was from the composite Q-sorts from six examiners. The other Q-sort measure of LH strategy at age 23 was from participants' self-sort of the CAQ. Comparing the results of the self-sort with sorts from raters allows for the evaluation of the relative predictive validities of the two Q-sort procedures. Additionally, a stable LH measure was computed by creating *z*-scores for each of the composite ratings at ages 14, 18, and 23 and then summing the *z*-scores.

Reproductive Behavioral Measures of LH Strategy

Sexual Debut Participants were asked the age at which they lost their virginity. Specifically, participants were asked how old they were the first time they engaged in sexual intercourse with the opposite sex. This question was posed during two data collection waves, ages 23 and 32. Because participation in the study varied with some participants supplying data at age 23, but not age 32, and some participants supplying data at age 32, but not 23, to maximize the sample size the responses for the two data collection waves were combined. If a participant supplied data at both collection waves, but the answer differed between waves the average of the two responses was used. In analyses, only heterosexual sex was included and only those who had lost their virginity were included.

Sexual Behaviors Three indices of sexual behavior were examined. At age 32, participants were asked for the number of sexual partners since the last data collection wave (age 23) and the number of sexual partners in the last year. Additionally, at age 32, participants were asked how often they have had sex in the previous year. To correct for skew in all three measures, the totals were log transformed.

Reproduction Three indices of reproductive history were examined. At age 32, women reported the number of abortions they had had and men reported the number of times they believed a partner had aborted a pregnancy. At age 32, participants also reported how old they were when their first child was born and the number of children they had. Only participants with biological children were included in analyses.

Venereal Disease At data collection waves for 23 and 32 years of age, participants were asked if they have had a venereal disease. Because participation in the study varied with some participants supplying data at age 23, but not age 32, and some participants supplying data at age 32, but not 23, to

maximize the sample size the responses for the two data collection waves were combined.

Results

Correlations Between Measures of LH Strategy

The correlations among the Q-sort measures of LH strategy are shown in Table 1. All of the measures exhibited a significant level of association; with the age 23 self-sort measure exhibiting the lowest degree of inter-measurement association.

Correlations Between Measures of LH Strategy and Reproductive Behaviors

The correlations between the Q-sort measures of LH strategy and the reproductive behaviors, with the exception of venereal disease contraction, are shown in Table 2. As seen in Table 3, LH strategy judged at each age, the composite Stable LH, and the age 23 self-sort were positively correlated with age of sexual debut. For number of partners since age 23, the negative correlations with LH strategy judged at each age and the composite Stable LH were significant, but the correlation with the self-sort at age 23 was not. For the number of partners in the past year, significant negative correlations were found with LH strategy judged at ages 14 and 23 and composite Stable LH. All measures of LH strategy, save the age 23 self-sort, were negatively correlated with number of abortions. For each of these variables, supplemental regression analyses (excluding age at first child and number of children) including sex as a dummy coded variable and hierarchical regression including a sex-LH strategy interaction term were also computed. No main effects for sex or sex-LH strategy interactions were significant.

The sample size for the variables of age at first birth and number of children was considerably smaller, consequently reducing power. However, for age at first birth, LH strategy judged at age 14 exhibited a significant positive correlation and the correlation with the composite Stable LH neared the conventional level of significance ($p < .06$). For the number of children, LH strategy judged at age 18, the composite Stable LH strategy, and the age 23 self-sort all exhibited significant negative correlations. The small sample size precluded additional supplemental analyses to examine possible sex differences.

Lastly, a series of t tests were performed with LH strategy as the dependent variable and the contraction of a venereal disease (yes or no) as the independent variable. The results of these analyses are shown in Table 3. For each measure of LH strategy, save LH judged at age 18, individuals with a slow LH strategy were less likely to report having contracted a venereal disease.

Assessing Differential Validity

Because the recorded sexual behaviors varied along demographic lines, it is important to examine the possible roles of sex, ethnicity, and socioeconomic status. It could be that the CAQ measure of LH strategy exhibits differential validity; it is a valid measure for one group, but not another. This is especially important because the raters who rated the participants had knowledge of the participant's demographic characteristics and this could quite possibly have impacted their ratings.

For sex and ethnicity, there are categories, male and female and Black and White (the sample size was too small for the examination of other ethnic groups). To test for differential validity, the correlations between Stable LH strategy and sexual debut were calculated within each

Table 1 Bivariate correlations among LH strategy scores

	14	18	23	23_{Self}
14	–			
18	$.67_{(N = 103)}$	–		
23	$.58_{(N =102)}$	$.69_{(N = 103)}$	–	
23_{Self}	$.47_{(N = 96)}$	$.48_{(N = 96)}$	$.62_{(N = 95)}$	–

All correlations were significant at $p < .001$

Table 2 Bivariate correlations between LH strategy and reproductive behaviors and outcomes

	Age of Q-sort				
	14	18	23	23_{Self}	Stable LH
Sexual debut	$.33^{**}_{(N = 92)}$	$.46^{***}_{(N = 92)}$	$.30^{*}_{(N = 91)}$	$.22^{*}_{(N = 87)}$	$.43^{***}_{(N = 90)}$
No. partners since age 23	$-.38^{**}_{(N = 70)}$	$-.28^{*}_{(N = 71)}$	$-.37^{**}_{(N = 71)}$	$-.12_{(N = 67)}$	$-.40^{**}_{(N = 70)}$
No. partners past year	$-.29^{*}_{(N = 67)}$	$-.22_{(N = 68)}$	$-.26^{*}_{(N = 68)}$	$-.11_{(N = 64)}$	$-.29^{*}_{(N = 67)}$
How often sex past year	$-.30^{*}_{(N = 68)}$	$-.22_{(N = 69)}$	$-.27^{*}_{(N = 65)}$	$-.13_{(N = 65)}$	$-.30^{*}_{(N = 68)}$
Number of abortions	$-.29^{*}_{(N = 75)}$	$-.29^{*}_{(N = 76)}$	$-.25^{*}_{(N = 75)}$	$-.25_{(N = 72)}$	$-.32^{**}_{(N = 74)}$
Age at first birth	$.49^{*}_{(N = 18)}$	$.38_{(N = 19)}$	$.36_{(N = 19)}$	$.44_{(N = 16)}$	$.46_{(N = 18)}$
No. of children)	$-.44_{(N = 18)}$	$-.57^{*}_{(N = 19}$	$-.42_{(N = 19)}$	$-.53^{*}_{(N = 16)}$	$-.55^{*}_{(N = 18)}$

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table 3 LH strategy means, SDs, and *t* tests, for participants reporting of venereal disease

Venereal disease	Age of Q-sort				
	14	18	23	23_{Self}	Stable K
Yes (n = 17)	31.89 (27.74)	40.63 (19.74)	40.24 (33.10)	34.04 (17.86)	.51 (2.28)
No (n = 79)	7.31 (36.48)	26.07 (32.17)	12.35 (44.51)	23.07 (21.11	−1.63 (3.23)
	$t(94) = 3.13$**	$t(18.64) = 1.80$	$t(94) = 2.96$**	$t(90) = 2.11$*	$t(93) = 3.24$**

* $p < .05$, ** $p < .01$

group. This procedure reduces the sample size substantially, especially for the Black ethnic group; therefore, because the sexual debut variable included the largest number of data points, it was chosen for analysis. Stable LH strategy was chosen as the LH measure because, being a composite, it was the most comprehensive measure. For each group, the correlation between LH strategy and sexual debut remained positive and significant: males, $r(42) = .48$, $p < .001$; females $r(48) = .39$, $p < .01$; Blacks $r(17) = .72$, $p < .001$; Whites $r(66) = .25$, $p < .05$.

Because socioeconomic status is a continuous variable, the analyses for testing differential validity with regards to socioeconomic status were different from those used for sex and ethnicity. First, a partial correlation between sexual debut and Stable LH strategy, controlling for socioeconomic status, was calculated. If the correlation was no longer significant, it opens up the possibility that raters were simply judging individuals based on their socioeconomic status. However, the partial correlation was significant, $r(80) = .30$, $p < .01$.

Second, a Continuous Parameter Estimation Model (CPEM) (Gorsuch, 2005) analysis was conducted. A CPEM analysis assesses the strength of the association between two variables along the continuous values of a third variable (avoiding less powerful techniques like median splits). Thus, CPEM allowed for the examination of whether the strength of the relationship between LH strategy and sexual debut varied across socioeconomic status.

To conduct a CPEM analysis, stable LH strategy and sexual debut were transformed into *z*-scores and then the *z*-scores were multiplied. A correlation between socioeconomic status and the product of stable LH strategy and sexual debut indicated if the strength of the association between stable LH strategy and sexual debut varied across socioeconomic status. A positive correlation indicated that as socioeconomic status increased, the strength of the association between stable LH strategy and sexual debut strengthened, a negative correlation indicated that as socioeconomic status increased, the strength of the association weakened. The correlation was $r(83) = -.12$, $p = .26$, indicating equivalence of the strength of the relationship between stable LH strategy and sexual debut across socioeconomic status.

Discussion

While the increasing influence of LH theory as a theoretical framework from which to understand variance in human behavior has led to the development of several measures of LH strategy, these measures rely upon self-reports and, therefore, they inherently have certain limitations (Copping et al., 2014). These limitations have become more apparent given recent critiques of self-report measures, backed-up by empirical findings illustrating that the ratings of independent raters result in more accurate prediction of future behaviors than self-reports. Thus, there appears to be a place for a behavioral rating measure of LH strategy. Sherman et al. (2013) have developed such a measure using the CAQ. Indeed, in their initial research, the CAQ measure of LH strategy predicted a number of interesting behaviors. However, more research is needed to examine the validity of this measure. For example, while Sherman et al. showed that the CAQ measure of LH strategy predicted a number of interesting behaviors, these behaviors (e.g., tempo of speech) were, however, only indirectly associated with LH strategy.

The purpose of the current study was to further examine the utility of the CAQ measure of LH strategy through secondary analyses of the Block and Block (2006b) 30-year longitudinal study. The data allowed for prospective analyses (up to 18 years) with multiple measures of LH strategy and multiple criterion variables reflecting reproductive behaviors, variables closely aligned with, if not largely defining, LH strategy.

The first set of analyses examined the stability of LH strategy ratings across time and found correlations from age 14 to 23 were $r > .50$ for all but the self-sort at age 23. It appears, then, that LH strategy as measured by the CAQ is relatively stable by age 14. This finding is consistent with an emphasis on prepubescent (e.g., Del Giudice & Belsky, 2011; Ellis, Shirtcliff, Boyce, Deardorff, & Essex, 2011) and genetic influences on LH strategy (Figueredo, Vásquez, Brumbach, & Schneider, 2004).

Variance in reproductive behaviors (e.g., age of sexual activity, number of sexual partners, and frequency of intercourse) is at the heart of LH strategies. While there was some variance based on the year at which LH strategy was measured, there was a clear trend in which LH strategy as measured by the CAQ was a significant predictor of reproductive behaviors. For example,

LH strategy measured at age 14 was a significant predictor of all the measures of reproductive behaviors, save number of children. Even in the case of the number of children, the trend was in the expected direction with a moderate to large effect size, but power was limited due to low sample size (N = 18). Thus, by age 14, individual differences in LH strategy, as measured by the CAQ, predicted individual's future reproductive behaviors. Another trend was that while the age 23 self-sort exhibited some predictive efficacy, overall it explained less variance in the criterion variables than the rater sorts. This suggests that rater sorts are preferable.

Also, the finding that a slow LH strategy was negatively associated with abortion runs counter to recent findings by Krupp (2012). Krupp found that at the level of Canadian provinces, abortion rate was positively associated with life expectancy (an important environmental cue impacting LH strategy). We speculate that differences in the level of analysis (province or individual) and location (Canada or the United States) are reasons for the discrepancy. It is thought that the higher frequency of intercourse and intercourse with a larger number of partners associated with a fast LH strategy results in a greater likelihood of unplanned and unwanted pregnancies, resulting in the association between a fast LH strategy and abortion found in the current investigation. However, the relationship between LH strategy and abortion may be moderated by a complex of environmental and developmental variables which supersede a simple linear association between LH strategy and abortion (Hill & Low, 1992; Tullberg & Lummaa, 2001).

Limitations and Future Research

To conclude, the results were consistent with those of Sherman et al. (2013), adding to the evidence that the CAQ measure of LH strategy has appropriate psychometric properties. Despite clear and valid calls for the use of behavioral based measures over self-report measures, it remains just as clear that self-report measures win, hands down, on the all-important aspects of convenience and ease of use. The results of Sherman et al. and of the secondary analyses of the Block and Block (2006a) data attest to the potential of the CAQ measure of LH strategy, but expecting a large shift away from self-reports would be foolhardy. Despite recent findings (Copping et al., 2014) questioning the psychometric properties of the self-report measures of LH strategy, the accumulation of research findings using the self-report measures are indicative of their utility. While the CAQ measure *may* be "better" (i.e., a more accurate predictor of behavior), it is clearly much more cumbersome to use. To begin, independent raters (with the recommendation there be multiple raters) must observe the target's behavior (with the recommendation that there be multiple meaningful behaviors observed). Next, the observers must use the CAQ to Q-sort the target with the Q-sorts themselves taking 20–30 min each.

In order to make the CAQ measure of LH strategy more practical for researchers, it is suggested that ways to reduce the expenditure of resources entailed in using the measure be explored. This could be achieved by reducing the number of items in the Q-set, by testing to see if the items have predictive value when employing an easier to use Likert-type scale as opposed to Q-sort methodology, and/or identifying how much and of what type of behavior is most telling in order to narrow the number of behaviors needed to make valid ratings. The results of the current investigation suggest that this might be a worthwhile endeavor.

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Appendix: The 20 CAQ-set Items Most Descriptive of LH Strategy

Most descriptive of a slow LH strategy: favors conservative values, high aspiration level for self, moralistic, behaves in a giving way to others, protective of those close to him or her, warmth/capacity for close relationships, genuinely dependable person, sympathetic/considerate, productive/gets things done, behaves in an ethically consistent manner.

Most descriptive of a fast LH strategy: guileful/deceitful/and manipulative, unable to delay gratification, unpredictable in behavior/attitudes, keeps people at a distance, basically distrustful of others, is self-indulgent, hostile towards others, rebellious/nonconforming, perceives contexts in sexual terms, rapid personal tempo.

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