Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid



Satoshi Kanazawa ^{a,b,c,*}, Kaja Perina ^d

^a Department of Management, London School of Economics and Political Science, Houghton Street, London WC2A 2AE, United Kingdom

^b Department of Psychology, University College London, United Kingdom

^c Department of Psychology, Birkbeck College, University of London, United Kingdom

^d Psychology Today, 115 E. 23rd Street, 9th Floor, New York, NY 10010, United States

ARTICLE INFO

Article history: Received 4 February 2009 Received in revised form 6 May 2009 Accepted 11 May 2009 Available online 27 June 2009

Keywords: Origin of values and preferences Evolutionary psychology The Savanna Principle The Savanna-IQ Interaction Hypothesis Circadian rhythms Chronobiology

ABSTRACT

The origin of values and preferences is an unresolved theoretical problem in social and behavioral sciences. The Savanna–IQ Interaction Hypothesis suggests that more intelligent individuals are more likely to acquire and espouse evolutionarily novel values and preferences than less intelligent individuals, but general intelligence has no effect on the acquisition and espousal of evolutionarily familiar values and preferences. Individuals can often choose their values and preferences even in the face of genetic predisposition. One example of such choice within genetic constraint is circadian rhythms. Survey of ethnographies of traditional societies suggests that nocturnal activities were probably rare in the ancestral environment, so the Hypothesis would predict that more intelligent individuals are more likely to be nocturnal than less intelligent individuals. The analysis of the National Longitudinal Study of Adolescent Health (Add Health) confirms the prediction.

© 2009 Elsevier Ltd. All rights reserved.

1. Introduction

Where do individual values and preferences come from? Why do people like or want what they do? The origin of individual values and preferences is one of the remaining theoretical puzzles in social and behavioral sciences (Kanazawa, 2001).

Recent theoretical developments in evolutionary psychology may suggest one possible explanation. On the one hand, evolutionary psychology (Crawford, 1993; Symons, 1990; Tooby & Cosmides, 1990) posits that the human brain, just like any other organ of any other species, is designed for and adapted to the conditions of the ancestral environment (roughly the African savanna during the Pleistocene Epoch), not necessarily to the current environment. It may therefore have difficulty comprehending and dealing with entities and situations that did not exist in the ancestral environment (Kanazawa, 2002, 2004a). On the other hand, an evolutionary psychological theory of the evolution of general intelligence proposes that general intelligence may have evolved as a domain-specific adaptation to solve evolutionarily novel problems, for which there are no predesigned psychological adaptations (Kanazawa, 2004b, 2008).

The synthesis of these two theories, *the Savanna–IQ Interaction Hypothesis* (Kanazawa, 2010), implies that the human brain's diffi-

* Corresponding author. Address: Department of Management, London School of Economics and Political Science, Houghton Street, London WC2A 2AE, United Kingdom. Tel.: +44 20 7955 7297.

E-mail address: S.Kanazawa@lse.ac.uk (S. Kanazawa).

culty with evolutionarily novel stimuli may interact with general intelligence, such that more intelligent individuals have less difficulty with such stimuli than less intelligent individuals. In contrast, general intelligence may not affect individuals' ability to comprehend and deal with evolutionarily familiar entities and situations. The Hypothesis, applied to values and preferences, may suggest that more intelligent individuals are more likely to acquire and espouse evolutionarily novel values than less intelligent individuals, whereas general intelligence does not affect the acquisition and espousal of evolutionarily familiar values. In this paper, we test this prediction with respect to one value domain (circadian rhythms), which is under some genetic influence. We show that, consistent with the Hypothesis, more intelligent individuals are more likely to be nocturnal than less intelligent individuals.

2. Choice within genetic predisposition

Choice is not incompatible with or antithetical to genetic influence. As long as $h^2 < 1.0$, genes merely set a broad reaction range, and individuals can still exercise some choice within broad genetic constraints. For example, political scientists have discovered that two genes are responsible for predisposing individuals to be more or less likely to vote in elections (Fowler & Dawes, 2008). However, individuals can still choose to turn out to vote or not for any election, and there are environmental (nongenetic) factors that can predict their voting (Kanazawa, 1998, 2000).

Similarly, genetic influences and constraints do not preclude individual acquisition and espousal of values and preferences.



^{0191-8869/\$ -} see front matter \circledcirc 2009 Elsevier Ltd. All rights reserved. doi:10.1016/j.paid.2009.05.021

Individuals can still choose certain values and preferences even in the face of genetic predisposition. For example, both political ideology (Alford, Funk, & Hibbing, 2005) and religiosity (Bouchard, McGue, Lykken, & Tellegen, 1999; Koenig, McGue, Krueger, & Bouchard, 2005) have now been shown to have genetic bases; some individuals are genetically predisposed to be liberal or conservative, or more or less religious. Yet more intelligent children are more likely to grow up to be liberal and less likely to grow up to be religious (Kanazawa, 2010). In this paper, we focus on one example of such choice within genetic constraints: whether one is a morning person or a night person (circadian typology).

3. Circadian typology (morningness-eveningness)

Virtually all species in nature, from single-cell organisms to mammals, including humans, exhibit a daily cycle of activity called the circadian rhythm. "This timekeeping system, or biological "clock," allows the organism to anticipate and prepare for the changes in the physical environment that are associated with day and night, thereby ensuring that the organism will "do the right thing" at the right time of the day" (Vitaterna, Takahashi, & Turek, 2001, p. 85). The circadian rhythm in mammals is regulated by two clusters of nerve cells called the suprachiasmatic nuclei (SCN) in the anterior hypothalamus (Klein, Moore, & Reppert, 1991). Geneticists have by now identified a set of genes that regulate the SCN and thus the circadian rhythm among mammals (King & Takahashi, 2000). A behavior genetic study of South Korean twins (n = 977pairs) shows that heritability in morningness-eveningness is .45 and nonshared environment accounts for 55% of the variance, while shared environment does not appear to explain any of the variance in it (Hur, 2007).

"For most animals, the timing of sleep and wakefulness under natural conditions is in synchrony with the circadian control of the sleep cycle and all other circadian-controlled rhythms. Humans, however, have the unique ability to cognitively override their internal biological clock and its rhythmic outputs" (Vitaterna et al., 2001, p. 90; emphasis added). While there are some individual differences in the circadian rhythm, where some individuals are more nocturnal than others, humans are basically a diurnal (as opposed to nocturnal) species. Humans rely very heavily on vision for navigation but, unlike genuinely nocturnal species, cannot see in the dark or under little lighting, and our ancestors did not have artificial lighting during the night until the domestication of fire. Any human in the ancestral environment up and about during the night would have been at risk of predation by nocturnal predators. It is therefore safe to assume that our ancestors rose at around dawn and went to sleep at around dusk, to take full advantage of the natural light provided by the sun, and the "night life" (sustained and organized activities at night after dusk) is probably evolutionarily novel.

In order to ascertain the extent to which our ancestors might have engaged in nocturnal activities, we have consulted ethnographic records of traditional societies throughout the world. In the 10-volume compendium *The Encyclopedia of World Cultures* (Levinson, 1991–1995), which extensively describes *all* human cultures known to anthropology, there is no mention of nocturnal activities in any of the traditional cultures. There are no entries in the index for "nocturnal," "night," "evening," "dark(ness)," and "all-night." The few references to the "moon" are all religious, as in "moon deity," "Mother Moon (deity)," and "moon worship." The only exception is the "night courting," which is a socially approved custom of premarital sex observed among the Danes and the Finns, which are entirely western cultures far outside of the ancestral environment. In addition, we have consulted the following extensive (monograph-length) ethnographies of traditional societies around the world: Yanomamö (Chagnon, 1992); From Mukogodo to Maasai: Ethnicity and Cultural Change in Kenya (Cronk, 2004); Ache Life History: The Ecology and Demography of a Foraging People (Hill & Hurtado, 1996); The !Kung San: Men, Women, and Work in a Foraging Society (Lee, 1979); and Sacha Runa: Ethnicity and Adaptation of Ecuadorian Jungle Quichua (Whitten, 1976). Many of these ethnographies contain a section where the authors describe what usually happens and what people routinely do in a typical day in the tribal society under study.

These detailed ethnographic records make it clear that the day for people in these traditional societies begins shortly before sun rise, and ends shortly after sun set. "Daily activities begin early in a Yanomamö village" (Chagnon, 1992, p. 129). "The day begins about 6 a.m., when the sun is about to rise" (Cronk, 2004, p. 88). The only routine activities conducted after dark are people conversing and visiting with each other as they drift off to sleep. "Despite the inevitable last-minute visiting, things are usually quiet in the village by the time it is dark" (Chagnon, 1992, p. 132). "Most evenings are spent quietly chatting with family members indoors. If the moon is full then it is possible to see almost as well as during the day, and people take advantage of the light by staying up late and socializing a great deal" (Cronk, 2004, p. 93). "After cooking and consuming food, evening is often the time of singing and joking. Eventually band members drift off to sleep, with one or two nuclear families around each fire" (Hill & Hurtado, 1996, p. 65). The only nocturnal activities, other than chatting, visiting, and making speeches, that we can find in all of these ethnographies is when Mukogodo men go searching for missing animals in the dark, if one happens to be missing (Cronk, 2004, p. 92).

Ethnographic evidence of traditional societies therefore suggests that our ancestors probably had a largely diurnal lifestyle, and sustained and routine nocturnal activities may be evolutionarily novel. The Savanna–IQ Interaction Hypothesis would therefore predict that more intelligent individuals are more likely to be nocturnal, getting up later in the morning and going to bed later in the evening, than less intelligent individuals. To our knowledge, there is only one study which examines the association between intelligence and circadian rhythm. Roberts and Kyllonen (1999) find that, in a small sample of United States Air Force recruits (n = 420), evening types are significantly more intelligent than morning types. We seek to replicate their findings in a large, nationally representative sample of Americans.

4. Empirical analysis

4.1. Method

4.1.1. Data: National Longitudinal Study of Adolescent Health (Add Health)

A sample of 80 high schools and 52 middle schools from the US was selected with unequal probability of selection. Incorporating systematic sampling methods and implicit stratification into the Add Health study design ensures this sample is representative of US schools with respect to region of country, school size, school type, and ethnicity. A sample of 20,745 adolescents were personally interviewed in their homes in 1994–1995 (Wave I), and again in 1996 (Wave II; n = 14,738). In 2001–2002, 15,197 of the original Wave I respondents, now age 18–28, were interviewed in their homes. Our sample consists of Wave III respondents.

4.1.2. Dependent variable: nocturnality

Add Health asks its respondents about their sleeping habits with four different questions in Wave III. "On days when you go to work, school, or similar activities, what time do you usually wake up?" "What time do you usually go to sleep the night (or day) before?" "On days you don't have to get up at a certain time, what time do you usually get up?" "On those days, what time do you usually go to sleep the night or day before?" We call the first type of days "weekdays" and the latter type of days "weekend."

For each question, the respondent indicates the time by first marking the hour (from 1:00 to 12:00), then the minute (from 00 to 59), and finally indicating whether the hour is AM or PM. The distributions of indicated bedtimes show that a large number of respondents (n = 3,073, 20.2% for weeknights, and n = 2,971, 19.5% for weekends) claim to go to bed at 12:00PM (noon) and 12:30PM (half an hour after noon), when very few people claim to go to bed during the 11:00 h or the 13:00 h. We assume this is a result of the confusion of 12:00AM (midnight) and 12:00PM (noon). We have therefore changed all 12:00 h bedtime to 00:00 h bedtime. The reassignment of these cases does not affect our substantive conclusion at all; in fact, the predicted effect of intelligence on nocturnality is slightly *stronger* if we delete all of these cases rather than reassign them.

4.1.3. Independent variable: childhood IQ

Add Health measures respondents' intelligence with the Peabody Picture Vocabulary Test (PPVT). The raw scores (0-87) are age-standardized and converted to the IQ metric, with a mean of 100 and a standard deviation of 15. The PPVT is a valid measure of verbal intelligence, not general intelligence. However, verbal intelligence is known to be highly correlated with (and thus heavilv loads on) general intelligence. Miner's (1957) extensive review of 36 studies shows that the median correlation between vocabulary and general intelligence is .83. Wolfle (1980) reports that the correlation between a full-scale IQ test (Army General Classification Test) and the General Social Surveys synonyms measure is .71. As a result, the GSS synonyms measure has been used widely by intelligence researchers to assess trends in general intelligence (Huang & Hauser, 1998). In order to establish the direction of causality more clearly, we will use the measure of intelligence taken in Wave I (in 1994–1995 when the respondents were in junior high and high school) to predict their adult nocturnality in Wave III (in 2001-2002 when the respondents were in their early adulthood).

Control variables. We control for the following variables: age (even though there is very little variance in it given that these are cohort data); sex (0 if female, 1 if male); race (with three dummies for Asian, black, and Native American, with white as the reference category); marital status (1 if currently married); parental status (1 if parent); education (years of formal schooling); earnings (in dollars); and religion (with four dummies for Catholic, Protestant, Jewish, and other, with none as the reference category).

Further, because previous studies show that students are more likely to be nocturnal than comparable individuals in full-time employment (Mecacci & Zani, 1983), we control for whether or not the respondent is a student (1 if currently in school). In addition, because demands of work can affect one's sleeping patterns, we control for how many hours the respondent typically works in a week.

5. Results

Fig. 1 presents bivariate associations between childhood IQ and chronobiology. We divide the Add Health sample into five "cognitive classes" (Herrnstein & Murray, 1994) by childhood IQ: "Very dull" (IQ < 75); "Dull" (75 < IQ < 90); "Normal" (90 < IQ < 110); "Bright" (110 < IQ < 125); and "Very bright" (IQ > 125). Fig. 1, Panel (a), shows that there is a monotonic association between cognitive

class and the time Add Health respondents go to bed on weeknights. "Very dull" individuals (n = 584) on average go to bed at 23:41; "dull" individuals (n = 2,967) go to bed at 00:03; "normal" individuals (n = 6,820) go to bed at 00:10; "bright" individuals (n = 3,483) go to bed at 00:21; and "very bright" individuals (n = 468) go to bed at 00:29. The absolute differences in minutes are small, but all the differences between two adjacent categories are statistically significant, except for "bright" and "very bright."

Fig. 1, Panel (b), similarly shows that, while individuals of all cognitive classes go to bed roughly one hour later on weekends than they do on weeknights, there is still a monotonic association between cognitive class and the time Add Health respondents go to bed on weekends. "Very dull" individuals (n = 585) on average go to bed at 00:35; "dull" individuals (n = 2,985) go to bed at 01:03; "normal" individuals (n = 6,854) go to bed at 01:11; "bright" individuals (n = 465) go to bed at 01:44. All the differences between two adjacent categories are statistically significant.

Fig. 1, Panel (c), shows that there is a monotonic association between cognitive class and what time Add Health respondents wake up on weekday morning. "Very dull" individuals (n = 583) on average wake up at 07:20; "dull" individuals (n = 2,965) wake up at 07:25; "normal" individuals (n = 6,814) wake up at 07:32; "bright" individuals (n = 3,480) wake up at 07:40; and "very bright" individuals (n = 468) wake up at 07:52. All the differences between two adjacent categories are statistically significant, except for "very dull" and "dull."

Finally, Fig. 1, Panel (d), shows that, while individuals of all cognitive classes wake up roughly three hours later on weekends than they do on weekdays, there is still a monotonic association between cognitive class and what time Add Health respondents wake up on weekend morning. "Very dull" individuals (n = 586) on average wake up at 10:09; both "dull" individuals (n = 2,986) and "normal" individuals (n = 6,850) wake up at 10:14; "bright" individuals (n = 3,488) wake up at 10:23; and "very bright" individuals (n = 466) wake up at 11:07. Only the differences between "normal" and "bright" and between "bright" and "very bright" are statistically significant.

Table 1 presents the results of OLS regression analyses of Add Health respondents' circadian rhythms. (The dependent variable here is converted from the normal base-60 sexagesimal time to the base-10 decimal time.) The first column shows that, net of age, sex, race, marital status, parental status, education, earnings, religion, student status and number of hours worked, childhood IQ significantly delays the time that Add Health respondents usually go to bed on weeknight. Older respondents (even in this limited age range) go to bed earlier than younger respondents, and men go to bed later than women. Consistent with expectations, married individuals and parents go to bed earlier. Christians (Catholics and Protestants) go to bed earlier, and, consistent with a previous finding (Mecacci & Zani, 1983), current students go to bed later than nonstudents. As expected, individuals who work more hours go to bed earlier.

Table 1, second column, shows that, net of the same control variables, childhood IQ significantly delays the time that Add Health respondents usually go to bed on weekends. Most of the other variables in the equation have the same effect on weekend bedtime as they do on weeknight bedtime, with the exception that blacks go to bed significantly later than whites on weekends but not on weeknights. Marital and parental statuses have much greater negative effect on weekend bedtime.

Table 1, third column, shows that, net of the same control variables, childhood IQ significantly delays the time that Add Health respondents usually wake up on weekdays. Most of the other variables in the equation have the same effect on what time they wake



Fig. 1. Bivariate association between childhood IQ and chronobiology. Note: Error bars represent the standard error for the mean.

up on weekdays as they do on what time they go to bed on weeknights, with the exception that more educated people wake up earlier on weekdays. While individuals who work longer hours go to bed earlier and wake up earlier on weekdays, students go to bed *later* and wake up *earlier*. Table 1, fourth column, shows that, while the effect of childhood IQ on what time Add Health respondents wake up on weekend is once again positive, its effect does not reach statistical significance (p > .18). Most of the other variables have the same effects as before.

An anonymous reviewer suggests that the Savanna–IQ Interaction Hypothesis may also imply that more intelligent individuals have a greater variance in their chronobiology than less intelligent individuals. It does not appear to be the case, however, with the Add Health data. The test of homogeneity of variances shows that variances are heterogeneous by childhood cognitive class in weekday time to go to bed (Levene statistic = 14.590, df = 4, 14317, p < .001), weekend time to go to bed (Levene = 15.295, df = 4,

14372, p < .001), and weekday time to wake up (Levene = 3.182, df = 4, 14305, p < .05), but not in weekend time to wake up (Levene = 2.084, df = 4, 14371, p > .05). However, for weekday and weekend time to go to bed, variance *decreases* with childhood intelligence; for weekday time to wake up, it has an inverted U-shaped distribution, with the greatest variance among the "normal" childhood IQ category.

Taken together, results presented in Table 1 largely support our hypothesis that more intelligent individuals are more likely to be night owls. The effect of childhood IQ on three out of four measures of nocturnality is significantly positive, even net of a large number of demographic and biological variables expected to affect circadian rhythms. However, we should point out that, while the effects of childhood IQ are highly statistically significant due to the large sample size, both the effect size (measured by the standardized regression coefficient) and the proportion of explained variance (R^2) are very small.

Table 1

The effect of childhood IQ on adult circadian typology (measured in hours) Add Health.

PerturbationWeeknight </th <th></th> <th colspan="2">Time to go to bed</th> <th colspan="2">Time to wake up</th>		Time to go to bed		Time to wake up	
Childhood IQ 0088"" 0073" 0073 0073 Age .0435 0529 .0443 .0144 Age 0430" 0495" 0893"" 2200" 0622 0688 0611 1219 1915" 0622 0688 0611 1219		Weeknight	Weekend	Weekday	Weekend
Age (A019) (M017) (M019) (M022) Age -M33 -M33 -M33 -M220 -0430 -0057" -M33" -2200" -0202 -0088 -0611 -1219 Sex -0121 2113" 540" (0 = fam.), 1 = male) (1053) (1043) (1050) (1057) (0 = fam.), 1 = male) (1053) (1053) (1057) (0650) Atan 0355 (1054) (0561) (1049) (017) (0650) Atan 0050 (1032) (0064) (0342) (0560) Matric American 0056 (1032) (0063) (0493) (0560) Matric American -0552 0006 0238 -0552 Matric American -0552 0006 0238 -0552 Matric American -0552 00061 -0013 -0603 Matric American -0552 0007 -0757 -0757 -0757 Matri A statu	Childhood IQ	.0080****	.0088****	.0078****	.0029
AgeAd35A529'A44'OJ41'Age0457''.0857'''.7200'''Age.0169'(.0149)(.0162)(.0159)Sex.0628.0611121'''007'''Sex.0628.0611121'''007'''Sex.0721.1280.04150060)Io = famile)05310471''0571'048507210280018''0571'0485Back0360018''017''0885Black070018''		(.0019)	(.0017)	(.0019)	(.0022)
Age0430°0557°°0983°°05220983°°0157(152)052068106111219540°540°540°540°0° = enale, 1 = male)(.0528)(.0433)(.0306)(.0607)540°540°.073121012101210°611°540°560°560°560°Roce21211.280°613°613°613°613°613°613°613°613°613°613°613°613°650°660°		.0435	.0529	.0443	.0134
"(D169)(D149)(D162)(D192)Sex	Age	0430^{*}	0957****	0893****	2200****
		(.0169)	(.0149)	(.0162)	(.0195)
Sex3332***6119****2113***5407***(0 = Fanale, 1 = male).0721.1280.0415.06501.0721.1280.0415.0859Ror.0313.0479.0731.0465Asian.0313.0479.0731.0465.0050.05961.05961.05711.00881.0060.0133.047.0751.0756.00561.04961.05711.00891.05711.0153.0226.0756.0757.0756.0164.0051.0053.0053.0288.0559.01717.00271.00681.0053.0089.01717.00281.0053.0089.0053.0168.01717.00481.00741.04831.01717.00281.01734.0081.00741.0181.01731.0174**.0154**.0059.01734.00481.01741.01431.0154.0294.0135.0135**.0135**.0129**.0174.0014.0131**.0111.01811.0174.0027**.0037**.0294.0294.0294.0135**.0125***.0294.0295.0175**.0125****.0125****.0128***.0175**.0128****.0135******.0128****.0155**.0137************************************		0282	0698	0611	1219
(0 = female, 1 = male)(0528)(0463)(0506)(0607)RereRereAsian(031)(079)(031)0455(0596)(0524)(0571)(0688)Black(0566)(0490)0352(0559)Black(0566)(0496)(0492)(0569)Native American0552.006602980276Asian.0056.02260076.0276Native American.0592.00660298.0689)Arial status (1 if currently married)0512.0066.0321.0689)Arial status (1 if parent)0648116501730499Arial status (1 if parent)0648116501370189Ariang00070031001300000000Ariang0151012301510259Parental status (1 if parent)0214047303270354Ariang00070000000000000000AriangAriangAriangAriangAriangAriang	Sex	.3832****	.6119****	.2113****	.5407****
norm norm norm norm norm Asian 0313 0479 0731 -0465 Asian (0556) (0554) (0571) (0686) 0060 0103 047 -0076 0060 0103 047 -0076 00740 0890 -0352 (0566) 0053 0252 -0076 0278 Native American -0552 0006 0289 -0559 00717 (0629) (0688) (0825) -0689 10717 (0629) (0688) (0825) -0690 10717 (0629) (0648) (0790) (0843) 10731 (0648) -0797 -3207 -6755 (0733) (0648) (0790) (0843) -0109 10734 (0644) -0479 -1245 6dvation -0214 -0312 -0384 -0357 1025 -0249 -0129 -0249 -0249	(0 = female, 1 = male)	(.0528)	(.0463)	(.0506)	(.0607)
karaAdian0.0130.4790.7310.4945Asian0.0330.0790.0710.08800.09710.0880Bach0.0600.0900.0470.05590.05610.05420.0569Attive American0.0510.0260.0760.05920.06690.05930.05930.0593Attive American0.0510.05290.06680.0688)0.06290.0688)0.0629Marial status (1 if currently married)46917419'''3207'''76520.0648)0.064910.064910.064910.064910.064910.064910.064910.064910.064910.064910.064910.061910.04530.064910.061910.04530.064910.01280.064910.01280.064910.01280.064910.01280.064910.01280.0028	(,,	.0721	.1280	.0415	.0859
Asian031304790731-04651005661010300571(05871)(05861)0066001030.01720.01720.02521055002960-005200060.0293-0057Natire American-005200060.0893-005910171706070.06810.00700.033-0080Arital status (1 if currently married)-01070.0010.033-0080101717064810.107090.04491-007611017170.064810.107090.04491-007611017170.064810.107090.04491-00521017170.064810.107090.04491-00521017170.064810.107090.0491-0052101717-01641-0172-01814-0172101717-01641-0172-01814-0051101717-01814-0173-0051-0051101717-01814-0173-0051-005110171-0181-0173-0051-009110171-0181-0173-0173-0173101717-0173-0173-0173-0173101717-0174-0173-0173-0174101717-0175-0174-0174-0174101717-0181-0175-0174-0174101717-0181-0174-0174-0174101717-0181-0174-0174-017410171<	Race				
(.0596)(.0524)(.0571)(.0086)Black.0740.0800.0137.0147.0757Black.0740.0860.0552.1578.05650.0266.0268.0252Natire American.0552.0006.0288.0559.0100.0007.00683.0269.0101.0007.0053.0080Mariat status (1 if currently married).4591".7419".3207".06683.0100.0001.0053.0080.0211.00443.07091.00843.0240".0517".3155".10123".0240".06481.0479.1494.0241.06414.0479.1494.0241.0312".0384.0596".0100.0001.0000.0000.0000.0001.0001.0001.0001.0001.0112.0138.0151.0181.0112.0138.0151.0189.0112.0001.0000.0000.0000.0000".0000".0000.0000.0000".0000.0000.0001.0001.0001.0001.0013.0013.0131.0131.0114.0151.0181.0114.0151.0181.0114.01671.0163.0114.01671.0163.0114.01671.0163.0114.01671.0163.0114.01671.0163.0	Asian	.0313	.0479	.0731	0465
0060 0103 0147 -0076 Black 00740 0080° -0552 1578 0153 02266 -0076 0276 Native American -0592 00066 0298 -0559 07171 (0629) (0639) (0632) (0632) Marital staus (1 if currently married) -4591 -7419" -3070" -8765 0739 (0648) -1066 -0073 -0089 Parental status (1 if parent) -2040" -5027" -3155" -0128" -0173 (0644) (0709) (0648) -0129" -0277 -8164 -0073 -0898 -1245 Education -0214 -0312" -0984" -0129" -0157 -0255 -0391" -0391" -0391" Education -0157 -0255 -0391" -0391" -0391" -0157 -0255 -0391" -0391" -0391" -0391" Education -2124" -		(.0596)	(.0524)	(.0571)	(.0686)
Black .0740 .0980° 0352		.0060	.0103	.0147	0076
(0566) (0496) (052) (0050) (0620) Native American -0592 0006 0298 -0559 Marial status (1 if currently married) -0513 -0629) (0668) (0825) Marial status (1 if currently married) -0491 -7419" -3207" -5755" Parental status (1 if parent) -0464 -1166 -0473 -06080 Acode (1) -0648 -1166 -0473 -06080 Parental status (1 if parent) -02040" -5027" -3155" -10129" Education -0277 -05154 -0734 -0614 -0794 -1245 Education -0217 -0514 -079 -1245 -0506 -0297 -0354 -0506 -0369 -0507 -0356 -0297 -0356 -0297 -0357 -0255 -0224 -0600 -0000" -0000" -0000" -0000" -0000" -0000" -0000" -0000" -0000" -0000" -0000" -0000" -0000" -000	Black	.0740	.0980*	0352	.1578 [*]
.0153 .026 .0076 .0276 Native American .0592 .0006 .0298 .0559 Marical status (1 if currently married)		(.0566)	(.0496)	(.0542)	(.0650)
<table-container>Native American0592.006.02880559(0717)(06629)(06688)(0825)Marital status (1 if currently married)45917419"3030"6785"(0739)(0648)(.0709)(0849)0648116604730808Parental status (1 if parent)20405027"3155"11129"(0734)(.0644)(.0704)(.0843)027408140379244502740814037924450214.0313101510161.00001(.0000)(.0000).0001.0001.00001.00001.00001.00001.00001.00001.00001.00001.00001.00001.048704763124"3184".04051.0001.00001.00001.00001.0407.0001.00001.00001.00001.0408704253124"3124".04081042604763124".040810027.00131.0001".04091.00071.00731.04871.04161.00871.01381.04871.04161.00871.0132.0435.04161.00871.01681.04671.04161.00871.01681.04671.04161.00871.01681.01681.04161.00871.01681.01681.04161.00871.01681</table-container>		.0153	.0226	0076	.0276
(0717) (0629) (0688) (0825) Marital status (1 if currently married) -0100 0001 0003 -0080 Marital status (1 if currently married) -4591**** -7419*** -320**** -6765*** (0739) (0644) (0709) (0849) Parental status (1 if parent) -0647 -3155**** -10129**** -02040******* -0647 -3155***** -10129*********** -0037 -0814 -0473 -1245 -0037 -0814 -0374 -0369** -0157 -0255 -0294 -0369 -0158 (0138) (0151) (0181) -0157 -0050 -0090 -0000 -0167 -0194 -0384 -0369 Earnings 0000*** -0042 -0194 -0369 Earnings -0167 -0476 -3124*** -3124*** Corront -00771 (0739) (0887) -0435 -0040 -0425 -0321 -5402	Native American	0592	.0006	.0298	0559
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		(.0717)	(.0629)	(.0688)	(.0825)
Marital status (1 if currently married) -4591**** -7491**** -7307*** -6755**** Parental status (1 if parent) -0648 1166 -0473 -0808 Parental status (1 if parent) -2040** -5027*** 3155*** -10129*** (0734) (0644) (0704) (0704) (0843) -0297 -0814 -0479 1245 Education -0157 -0254 0294 0312 -0157 -0257 0244 0359 0296 0368 -0157 0250 0294 0359 0368 0368 -0160 0000 00000 00000 00000*** 0000 00000*** 0194 3124*** Catholic 2128** 0476 3124*** 3124*** 3124*** Catholic 3106*** 4255**** 3220**** .3045*** Catholic 3106*** 4255**** 3220**** .5402**** Jewish (.3055) (.2840)		0100	.0001	.0053	0080
No. (0739) (0648) (0709) (0849) Parental status (1 if parent) 0648 0155 0808 Parental status (1 if parent) 0047 5027 3155***********************************	Marital status (1 if currently married)	4591****	7419****	3207****	6765****
		(.0739)	(.0648)	(.0709)	(.0849)
Parental status (1 if parent) 2040 ¹⁷ 5027 ¹⁷⁷ 3155 ¹⁷⁷⁷ -1.0129 ¹⁷⁷⁷ Education 0237 0814 0479 1245 Education 0214 0312 ² 0384 ⁴ 0596 ⁷ Internation (.0158) (.0138) (.0151) (.0181) Parana 0157 0255 0294 0000 ¹¹ Parana 0000 0000 .0000 ¹¹ .0000 ¹¹ (.0000) (.0000) (.0000) (.0000) .0000 ¹¹ (.0000) (.0000) (.0000) (.0000) .0000 ¹¹ Catholic 2128 ¹¹ 0476 3124 ¹¹¹ 3124 ¹¹¹ Catholic 2128 ¹¹ 0077 (.0739) (.0887) Protestant 3106 ¹¹¹ 0425 ¹¹¹ 3220 ¹¹¹ 5402 ¹¹¹ Jewish 4.470 1.745 551 3220 ¹¹ 5402 ¹¹¹ Jewish		0648	1166	0473	0808
(.0734) (.0644) (.0704) (.0843) 0297 0814 0479 1245 Education 0214 0312* 0384* 0596* .0158) (.0138) (.0151) (.0181) .0157 0225 0294 0369 .0000*** 0000 0000 0000) 0000 .0487 0042 0194 0387 Religion 0271 0077 0739 0435 .00011 (.0077) (.0739) 0887 .0351 0476 3124**** 5402*** .0402 0194 0435 6403*** 6403*** .04011 (.0677) (.0739) (.0887) 6403**** .0402 6063*********************************	Parental status (1 if parent)	2040^{**}	5027****	3155****	-1.0129****
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(.0734)	(.0644)	(.0704)	(.0843)
Education 0214 0312 ² 0384 ² 0596 ² (.0158) (.0138) (.0151) (.0181) 0157 0255 0294 0000 .0000		0297	0814	0479	1245
(0158) (0138) (0151) (0181) 0157 0255 0294 0369 .0000"" 0000 .0000 .0000 .0000 .0000"" .0000 .0000 .0000 .0000" .0000" .0087 .0042 .0194 .0387 Religion .01771 (.0677) (.0739) .0387 Protestant 0351 0087 0538 0443 016" 0877 0538 0443 Protestant 0361 0087 0320 5402" (0894) (.0784) (.0857) (.1027) .0409 0623 0442 .0601 Jewish .0145 .0063 .0086 .0089 .0145 .0063 .0086 .0089 .0014 .0015 .0145 .0063 .0086 .0089 .0016 .2142"" .0617 .0162 .2142"" .0163 .0284 .0264 .0409	Education	0214	0312 [*]	0384^{*}	0596**
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		(.0158)	(.0138)	(.0151)	(.0181)
Earnings .0000 ^{***} 0000 .0000 ^{***} .0000 ^{***} .0000 ^{***} Religion 042 0194 0387 Religion 017 .06677 .03124 ^{****} 03124 (.0771) (.0677) (.0739) (.0887) 042 0426 0353 0435 Protestant 0351 0087 0538 0403 0409 0623 0442 0601 Jewish .0409 0623 0442 0601 Jewish .0470 .1745 .2551 .3269 (.0000) .0063 .0086 .0089 Other .0162 212 ^{***} 1187 .4109 ^{****} .00111 .0578 .0086 .0082 .0086 .0082 Other .0162 .212 ^{*****} .0182 .0162 .0163 .0086 .0082 Currently in school (1 if currently in school) .1576 .0716 .2339 ^{***********************************}		0157	0255	0294	0369
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Earnings	.0000	0000	0000	0000^{****}
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		(.0000)	(.0000)	(.0000)	(.0000)
Religion -2128* 0476 3124** 3124** Catholic (.0771) (.0677) (.0739) (.0887) 0351 0087 3220** 5402*** Protestant 3106*** 4255*** 3220*** 5402*** (.0894) (.0784) (.0857) (.1027) .0409 0623 0442 .0601 .0305 (.2640) (.2880) (.3458) .0145 .0063 .0086 .0089 Other .0145 .0063 .0086 .0089 Other .0162 214*** 1187 4109*** .0175 .0627) .06855 .0082 .0906 .0161		.0487	0042	0194	0387
Arrigon 2128* 0476 3124*** 3124*** Catholic (.0771) (.0677) (.0739) (.0887) Protestant 0351 0087 3220*** 5402*** (.0894) (.0734) (.0857) (.1027) 0409 0623 0442 0601 049 0623 0442 0601 0051 (.2640) (.2880) (.3458) 0045 .0063 .0086 .0089 Other .0162 214*** 1187 4109*** 00751 (.0627) (.0685) (.0822) 0.016 .027 .0635 .0086 .0096 0.027 (.0685) (.0705) .0016 .0288 .0146 .0446 .0409*** 0.028 .0161 .0538) .0051*** .0061**** .0067**** .0067**** $0.051***$.0016 .0013 .0014***** .0067**** .0067***** $0.051*****$	Paligion				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Catholic	2128**	0476	3124****	3124***
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Protectant	2128	0470	(0730)	(0887)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		0351	0087	0538	0/35
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		3106***	4255****	3220***	0455
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Toestant	(0894)	(0784)	(0857)	(1027)
Jewish 005 025 042 0021 Jewish.4470.1745.2551.3269(.3005)(.2640)(.2880)(.3458)Other.0145.0063.0086.0089Other.0162 2142^{**} 1187 4109^{***} (.0715)(.0627)(.0685)(.0822).0030*.00438.0227.0637Currently in school (1 if currently in school).1576.0716.2339^{***}.0906(.0613)(.0538)(.0588)(.0705)Hours worked.0051**.0016.0081**.0067**(.0015)(.0013)(.0014)(.0017).0265.0130.0064.0409Constant6.56318.93445.749512.1950 k^2 .0254.0699.0258.0796Number of cases10,71510,73310,70710,731		0400	(.0784)	0442	(.1027)
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Jewish	0403	1745	2551	3260
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(2005)	(2640)	(2890)	(2459)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		(1.5005)	(.2040)	(.2880)	(.5458)
Outer -2.142 -1.167 -1.4102 $(.0715)$ $(.0627)$ $(.0685)$ $(.0822)$ $.0030$ 0438 0227 0637 Currently in school (1 if currently in school) $.1576$ $.0716$ $2339^{\bullet\bullet\bullet}$ $.0906$ $(.0613)$ $(.0538)$ $(.0588)$ $(.0705)$ $.0288$ $.0146$ 0446 $.0140$ Hours worked $0051^{\bullet\bullet\bullet}$ 0016 $0081^{\bullet\bullet\bullet}$ 0365 0130 0604 0409 Constant 6.5631 8.9344 5.7495 12.1950 $(.4011)$ $(.3520)$ $(.3846)$ $(.4611)$ R^2 $.0254$ $.0699$ $.0258$ $.0796$ Number of cases 10.715 10.733 10.707 10.731	Other	.0145	21/2***	1187	.0005
$ \begin{array}{c ccccc} (.0027) & (.0027) & (.0023) & (.0022) \\ 0.030 &0438 &0227 &0637 \\ 0.0906 & (.0613) & (.0538) & (.0588) & (.0705) \\ (.0613) & (.0538) & (.0588) & (.0705) \\ 0.288 & .0146 &0446 & .0140 \\ 0.0015 &0016 &0081 &0067 \\ (.0015) & (.0013) & (.0014) & (.0017) \\ 0.0015 &0365 &0130 &0604 &0409 \\ 0.0015 & (.4011) & (.3520) & (.3846) & (.4611) \\ R^2 & .0254 & .0699 & .0258 & .0796 \\ Number of cases & 10.715 & 10,733 & 10,707 & 10,731 \\ \end{array} $		(0715)	2142	1107	(0922)
Loops 033 0227 0037 Currently in school (1 if currently in school) $.1576$ $.0716$ 2339^{***} $.0906$ (.0613)(.0538)(.0588)(.0705).0288.0146 0446 .0140Hours worked 0051^{***} 0016 0081^{***} 0067^{***} (.0015)(.0013)(.0014)(.0017) 0365 0130 0604 0409 Constant 6.5631 8.9344 5.7495 12.1950 (.4011)(.3520)(.3846)(.4611) R^2 .0254.0699.0258.0796Number of cases10,71510,73310,70710,731		(.0713)	(.0027)	(.0085)	(.0822)
$ \begin{array}{c} (.0613) & (.0538) & (.0588) & (.0705) \\ (.0613) & (.0538) & (.0588) & (.0705) \\ .0288 & .0146 &0446 & .0140 \\ .0015) & (.0013) & (.0014) & (.0017) \\ .0015) & (.0013) & (.0014) & (.0017) \\ .00150 &0365 &0130 &0604 &0409 \\ Constant & 6.5631 & 8.9344 & 5.7495 & 12.1950 \\ (.4011) & (.3520) & (.3846) & (.4611) \\ R^2 & .0254 & .0699 & .0258 & .0796 \\ Number of cases & 10,715 & 10,733 & 10,707 & 10,731 \\ \end{array} $	Currently in school (1 if currently in school)	1576	0458	0227	0037
$(.0013)$ $(.0033)$ $(.0038)$ $(.0038)$ $(.0038)$ $.0288$ $.0146$ 046 $.0140$ Hours worked 0051^{***} 0016 0081^{****} $.0067^{****}$ $(.0015)$ $(.0013)$ $(.0014)$ $(.0017)$ 0365 0130 0604 0409 Constant 6.5631 8.9344 5.7495 12.1950 $(.4011)$ $(.3520)$ $(.3846)$ $(.4611)$ R^2 $.0254$ $.0699$ $.0258$ $.0796$ Number of cases $10,715$ $10,733$ $10,707$ $10,731$		(0612)	.0/10	2559	.0500
Hours worked.0258.0140 0440 .0140Hours worked 0051^{***} 0016 0081^{***} 0067^{***} (.0015)(.0013)(.0014)(.0017) 0365 0130 0604 0409 Constant 6.5631 8.9344 5.7495 12.1950 (.4011)(.3520)(.3846)(.4611) R^2 .0254.0699.0258.0796Number of cases10,71510,73310,70710,731		(.0013)	(.0538)	(.0388)	(.0703)
Indits worked00100100610061 $(.0015)$ $(.0013)$ $(.0014)$ $(.0017)$ 0365 0130 0604 0409 Constant 6.5631 8.9344 5.7495 12.1950 $(.4011)$ $(.3520)$ $(.3846)$ $(.4611)$ R^2 $.0254$ $.0699$ $.0258$ $.0796$ Number of cases 10.715 10.733 10.707 10.731	Hours worked	.0200	0016	0440	- 0067****
$(.0017)$ $(.0017)$ $(.0014)$ $(.0017)$ 0365 0130 0604 0409 Constant 6.5631 8.9344 5.7495 12.1950 $(.4011)$ $(.3520)$ $(.3846)$ $(.4611)$ R^2 $.0254$ $.0699$ $.0258$ $.0796$ Number of cases 10.715 10.733 10.707 10.731		(0015)	(0013)	(0014)	(0017)
0505 0150 004 0409 Constant 6.5631 8.9344 5.7495 12.1950 (.4011) (.3520) (.3846) (.4611) R ² .0254 .0699 .0258 .0796 Number of cases 10,715 10,733 10,707 10,731		(.0015)	(.0015)	(.0014)	(.0017)
Constant 6.5051 8.5344 5.7495 12.1950 $(.4011)$ $(.3520)$ $(.3846)$ $(.4611)$ R^2 $.0254$ $.0699$ $.0258$ $.0796$ Number of cases $10,715$ $10,733$ $10,707$ $10,731$	Constant	0303	0130	0004	0409
$(.4011)$ $(.3520)$ $(.3846)$ $(.4611)$ R^2 .0254.0699.0258.0796Number of cases10,71510,73310,70710,731	constant p ²	(4011)	0.9044	(2846)	12.1950
Number of cases .0254 .0059 .0258 .0/96 10,715 10,733 10,707 10,731		(.4011)	(.3520)	(.3840)	(.4011)
Number of cases 10,715 10,733 10,707 10,731	Λ Number of escar	.0234	.0099	.0258	.0796
		10,715	10,733	10,707	10,731

Note: Main entries are unstandardized regression coefficients. (Entries in parentheses are standard errors.). Entries in italics are standardized regression coefficients. * *p* < .05.

..... *p* < .001.

p < .0001 (two-tailed).

6. Conclusion

The Savanna-IQ Interaction Hypothesis suggests that more intelligent individuals may be more likely to acquire and espouse evolutionarily novel values and preferences than less intelligent individuals, while general intelligence may have no effect on the acquisition and espousal of evolutionarily familiar values and preferences. An earlier study (Kanazawa, 2010) has shown that more intelligent individuals are more likely to be liberal and atheist, and more intelligent men (but not women) are more likely to value sexual exclusivity, than their less intelligent counterparts. In this paper, we have extended the Hypothesis to circadian rhythms.

While studies show that there is some genetic component to individuals' circadian rhythms (Hur, 2007), heritability of these phenotypes is far from 1.0 and thus there is room for individual choices and decisions. Survey of ethnographies of traditional societies shows that routine nocturnal activities were probably rare in the ancestral environment and are thus evolutionarily novel. The Savanna-IQ Interaction Hypothesis therefore predicts that more intelligent individuals are more likely to be nocturnal than less intelligent individuals.

^{**} *p* < .01.

Our analysis of Add Health data supports the prediction derived from the Hypothesis. Net of age, sex, race, marital status, parental status, education, earnings, religion, whether one is currently a student and the number of hours worked per week, childhood IQ significantly increases nocturnal behavior in early adulthood. More intelligent children are more likely to grow up to be nocturnal adults who go to bed late and wake up late on both weekdays and weekends.

Our results in this paper, along with other empirical support for the Savanna–IQ Interaction Hypothesis, suggests the importance of general intelligence in the acquisition and espousal of preferences and values. Future studies of value acquisition should consider general intelligence as an important factor. One major weakness of the present analysis is that we do not have a direct measure of general intelligence, only verbal intelligence. While verbal intelligence is highly correlated with general intelligence, a future test of the Hypothesis can benefit from a direct measure of general intelligence. Future studies of the effect of general intelligence on circadian rhythms can also benefit from more direct behavioral measures of morningness–eveningness instead of verbal responses to survey questions. More empirical work is clearly necessary, both to test the Hypothesis rigorously and to investigate the origin of individual values.

Acknowledgements

This research uses data from Add Health, a program project designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris, and funded by a grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 17 other agencies. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Persons interested in obtaining data files from Add Health should contact Add Health, Carolina Population Center, 123 West Franklin Street, Chapel Hill, NC 27516-2524, USA (addhealth@unc.edu). No direct support was received from grant P01-HD31921 for this analysis. We thank David de Meza, Patrick M. Markey, Diane I. Revniers, and anonymous reviewers for their comments on earlier drafts. Direct all correspondence to: Satoshi Kanazawa, Department of Management, London School of Economics and Political Science, Houghton Street, London WC2A 2AE, United Kingdom.

References

- Alford, J. R., Funk, C. L., & Hibbing, J. R. (2005). Are political orientation genetically transmitted? American Political Science Review, 99, 153–167.
- Bouchard, T. J., Jr., McGue, M., Lykken, D., & Tellegen, A. (1999). Intrinsic and extrinsic religiousness: Genetic and environmental influences and personality correlates. *Twin Research*, 2, 88–98.

- Chagnon, N. (1992). Yanomamö (4th ed.). Harcourt Brace Jovanovich: Fort Worth. Crawford, C. B. (1993). The future of sociobiology: Counting babies or proximate mechanisms? Trends in Ecology and Evolution, 8, 183–186.
- Cronk, L. (2004). From Mukogodo to Maasai: Ethnicity and cultural change in Kenya. Westview: Boulder.
- Fowler, J. H., & Dawes, C. T. (2008). Two genes predict voter turnout. Journal of Politics, 70, 579–594.
- Herrnstein, R. J., & Murray, C. (1994). The bell curve: Intelligence and class structure in American life. New York: Free Press.
- Hill, K., & Hurtado, A. M. (1996). Ache life history: The ecology and demography of a foraging people. New York: Aldine.
- Huang, M.-H., & Hauser, R. M. (1998). Trends in black–white test-score differentials: II. The WORDSUM vocabulary test. In U. Neisser (Ed.). *The rising curve: Long-term gains in IQ and related measure* (pp. 303–332). Washington, DC: American Psychological Association.
- Hur, Y.-M. (2007). Stability of genetic influence on morningness–eveningness: A cross-sectional examination of South Korean twins from preadolescence to young adulthood. *Journal of Sleep Research*, 16, 17–23.
- Kanazawa, S. (1998). A possible solution to the paradox of voter turnout. Journal of Politics, 60, 974–995.
- Kanazawa, S. (2000). A new solution to the collective action problem: The paradox of voter turnout. American Sociological Review, 65, 433–442.
- Kanazawa, S. (2001). De gustibus est disputandum. Social Forces, 79, 1131–1163. Kanazawa, S. (2002). Bowling with our imaginary friends. Evolution and Human Behavior, 23, 167–171.
- Kanazawa, S. (2004a). The Savanna Principle. Managerial and Decision Economics, 25, 41–54.
- Kanazawa, S. (2004b). General intelligence as a domain-specific adaptation. *Psychological Review*, 111, 512–523.
- Kanazawa, S. (2008). Temperature and evolutionary novelty as forces behind the evolution of general intelligence. *Intelligence*, 36, 99–108.
- Kanazawa, S. (2010). Why liberals and atheists are more intelligent. Social Psychology Quarterly, 73(1), in press.
- King, D. P., & Takahashi, J. S. (2000). Molecular genetics of circadian rhythms in mammals. Annual Review of Neuroscience, 23, 713–742.
- Klein, D. C., Moore, R. Y., & Reppert, S. M. (1991). Suprachiasmatic nucleus: The mind's clock. New York: Oxford University Press.
- Koenig, L. B., McGue, M., Krueger, R. F., & Bouchard, T. J. Jr., (2005). Genetic and environmental influences on religiousness: Findings for retrospective and current religiousness ratings. *Journal of Personality*, 73, 471–488.
- Lee, R. B. (1979). The! Kung San: Men, women, and work in a foraging society. Cambridge: Cambridge University Press.
- Levinson, D. (Ed.), (1991–1995). Encyclopedia of world cultures (Vol. 10). Boston: G.K. Hall.
- Mecacci, L., & Zani, A. (1983). Morningness-eveningness preferences and sleepwaking diary data of morning and evening types in student and working samples. *Ergonomics*, 26, 1147–1153.
- Miner, J. B. (1957). Intelligence in the United States: A survey With conclusions for manpower utilization in education and employment. New York: Springer.
- Roberts, R. D., & Kyllonen, P. C. (1999). Morningness-eveningness and intelligence. Early to bed, early to rise will likely make you anything but wise! *Personality* and Individual Differences, 27, 1123-1133.
- Symons, D. (1990). Adaptiveness and adaptation. Ethology and Sociobiology(11), 427-444.
- Tooby, J., & Cosmides, L. (1990). The past explains the present: Emotional adaptations and the structure of ancestral environments. *Ethology and Sociobiology*, 11, 375–424.
- Vitaterna, M. H., Takahashi, J. S., & Turek, F. W. (2001). Overview of circadian rhythms. Alcohol Research and Health, 25, 85–93.
- Whitten, N. E. Jr., (1976). Sacha Runa: Ethnicity and adaptation of Ecuadorian jungle Quichua. Urbana: University of Illinois Press.
- Wolfle, L. M. (1980). The enduring effects of education on verbal skills. Sociology of Education, 53, 104–114.