



Happiness in modern society: Why intelligence and ethnic composition matter [☆]



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ABSTRACT

Recent developments in evolutionary psychology suggest that living among others of the same ethnicity might make individuals happier and further that such an effect of the ethnic composition on life satisfaction may be stronger among less intelligent individuals. Data from the National Longitudinal Study of Adolescent Health showed that White Americans had significantly greater life satisfaction than all other ethnic groups in the US and this was largely due to the fact that they were the majority ethnic group; minority Americans who lived in counties where they were the numerical majority had just as much life satisfaction as White Americans did. Further, the association between ethnic composition and life satisfaction was significantly stronger among less intelligent individuals. The results suggest two important factors underlying life satisfaction and highlight the utility of integrating happiness research and evolutionary psychology.

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1. Introduction

There are observable ethnic differences in life satisfaction (Krause, 1993; Okazaki, 1997; Scollon, Diener, Oishi, & Biswas-Diener, 2004). However, there currently exist no comprehensive explanations for such ethnic differences. Numerous evolutionary psychologists have written on happiness over the last decade and half (Buss, 2000; Hill & Major, 2012; Kenrick, Griskevicius, Neuberg, & Schaller, 2010; Nesse, 2004), and an increasing number of positive psychologists have more recently begun to draw on insights from evolutionary psychology (Diener, Kanazawa, Suh, & Oishi, 2015; Heintzelman & King, 2014). These positive psychologists argue that subjective well-being, and the related phenomenon of the sense of meaning in life, are adaptive because they facilitate the efficient execution of evolved psychological mechanisms. They suggest that happier individuals

with greater sense of meaning in life are more likely to engage in adaptive behavior and may have on average greater reproductive success. Happiness may therefore be evolutionarily selected (Kanazawa, in press).

One of the fundamental observations in evolutionary psychology is that, just like any other organ of any other species, the human brain is designed for and adapted to the conditions of the ancestral environment, not necessarily the current environment, and is therefore predisposed to perceive and respond to the current environment as if it were the ancestral environment (Tooby & Cosmides, 1990). Known variously as the *Savanna Principle* (Kanazawa, 2004), the *evolutionary legacy hypothesis* (Burnham & Johnson, 2005) or the *mismatch hypothesis* (Hagen & Hammerstein, 2006), this observation suggests that the human brain may have difficulty comprehending and dealing with entities and situations that did not exist in the ancestral environment, roughly the African savanna during the Pleistocene Epoch (Colarelli & Arvey, 2014; Kenrick & Griskevicius, 2013).

The Savanna Principle can explain why some otherwise elegant scientific theories of human behavior, such as game theory, often fail empirically, because they posit entities and situations that did not exist in the ancestral environment. For example, nearly half the players of one-shot Prisoner's Dilemma games make the theoretically irrational choice to cooperate with their partner (Sally, 1995). The Savanna Principle suggests that this may possibly be

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because the human brain has difficulty comprehending completely anonymous social exchange and absolutely no possibility of knowing future interactions (which together make the game truly one-shot and defection the only rational choice) (Hagen & Hammerstein, 2006; Kanazawa, 2001). Neither of these situations existed in the ancestral environment, where all social exchanges were in person and potentially repeated; however, they are crucial for the game-theoretic prediction of universal defection.

Further, recent developments in evolutionary psychology indicate that general intelligence may have evolved to solve evolutionarily novel problems (Kanazawa, 2010, 2012). Evolutionary psychology posits that evolved psychological mechanisms are relatively narrowly focused in terms of the information they process as input. They evolved to solve adaptive problems that recurrently presented themselves in different domains of life throughout human evolutionary history, such as social exchange, infant care, and incest avoidance (Tooby & Cosmides, 1992). They are domain-specific and operate only within narrow domains of life.

Recent theoretical developments suggests that general intelligence, far from being domain-general, may also have evolved as such a domain-specific evolved psychological mechanism. It may have evolved to allow individuals to solve a wide variety of *non-recurrent* adaptive challenges that also directly or indirectly affected survival or reproduction. All such non-recurrent adaptive problems were *evolutionarily novel*. General intelligence may thus have evolved to solve evolutionarily novel problems, as a psychological adaptation for the domain of evolutionary novelty.

This suggests that the evolutionary constraints on the human brain proposed by the Savanna Principle may be stronger among less intelligent individuals than among more intelligent individuals. More intelligent individuals, who possess higher levels of general intelligence and thus greater ability to solve evolutionarily novel problems, may face less difficulty in comprehending and dealing with evolutionarily novel entities and situations. In contrast, less intelligent individuals may face greater difficulty in dealing with evolutionarily novel entities and situations than more intelligent individuals.

For example, more intelligent individuals are more likely to make the theoretically rational choice to defect in one-shot Prisoner's Dilemma games (Kanazawa & Fontaine, 2013). This may be because more intelligent individuals are better able to comprehend the evolutionarily novel entities of complete anonymity and absolutely no possibility of knowing future interactions and make the rational decision to defect. In contrast, less intelligent individuals may have greater difficulty comprehending such evolutionarily novel entities, and, as a result, make the theoretically irrational (*albeit evolutionarily rational*) decision to cooperate (Kenrick & Griskevicius, 2013).

The Savanna Principle in evolutionary psychology, applied to life satisfaction, may suggest that it may not be only the consequences of a given situation in the current environment that influence individuals' life satisfaction but also what its consequences *would have been* in the ancestral environment. Having implicit difficulty comprehending and dealing with evolutionarily novel situations, the human brain may respond to the ancestral consequences of the current situation and individuals' life satisfaction may fluctuate accordingly. The evolutionary constraints on the human brain may incline individuals to experience a given situation as if it were taking place in the ancestral environment, not in the current environment, and be subject to its ancestral consequences for life satisfaction.

For example, our ancestors lived their entire lives in ethnically homogeneous groups (Oppenheimer, 2003). A multi-ethnic society like the United States today is a very recent phenomenon in human evolutionary history. Perhaps the clearest evidence of

the evolutionary novelty of ethnic diversity is the fact that, while humans appear to possess evolved psychological mechanisms to classify others automatically by sex and age, they do not possess a comparable mechanism to classify them by ethnicity (Kurzban, Tooby, & Cosmides, 2001). From the perspective of the Savanna Principle, this may be because individuals of varied sexes and ages existed in the ancestral environment and thus were evolutionarily familiar, whereas individuals of varied ethnicities did not exist in the ancestral environment and thus were evolutionarily novel.

In the ancestral environment, being among others who looked, spoke and behaved differently from oneself usually meant that one was captured or abducted by a neighboring group or at the very least that one was living without the assistance and cooperation of one's genetic kin and allies. Even though people of different ethnicities can live together harmoniously in modern multi-ethnic societies, being an ethnic minority would have been precarious in the ancestral environment, as neighboring tribes were often not friendly (Diamond, 2012).

Thus, despite the fact that living among others of different ethnicities today, especially in multi-ethnic societies like the United States, poses very few negative consequences that threaten survival and reproduction, the human brain, designed for and adapted to the ancestral environment, may nonetheless experience such situations as a potential threat, as it would have been in the ancestral environment. Individuals may consequently experience lower levels of life satisfaction. For instance, in a recent study, using an ingenious within-subject design, Burrow and Hill (2013) showed that train passengers experienced increased distress and negative mood when they were surrounded by passengers of different ethnicities. The Savanna Principle therefore suggests that the human brain may implicitly experience being surrounded by others of different ethnicities and being an ethnic minority as a potential threat, and, accordingly, life satisfaction may be lower in such circumstances.

Further, the evolutionary psychological perspective on general intelligence suggests that such an effect of living as an ethnic minority among others of different ethnicities on life satisfaction may be stronger among less intelligent individuals. More intelligent individuals may be better able to comprehend the evolutionarily novel situation of ethnic diversity and living as an ethnic minority for what it truly is today – a benign and safe situation. In contrast, less intelligent individuals may have greater difficulty comprehending the same evolutionarily novel situation of ethnic diversity and living as an ethnic minority and may perceive it as if it were in the ancestral environment – a potentially dangerous and threatening situation. As a result, less intelligent individuals' life satisfaction may decrease to a greater degree than that of more intelligent individuals when faced with ethnic diversity and living as an ethnic minority. The theoretical logic would therefore suggest that ethnic diversity and intelligence may have a statistical interaction effect on life satisfaction.

Key insights from evolutionary psychology therefore suggest that the degree of ethnic homogeneity – the extent to which one lives among others of the same ethnicity – may have a positive effect on life satisfaction and further that such an effect of ethnic homogeneity on life satisfaction will be stronger among less intelligent individuals. In particular, the theoretical logic would lead us to predict that, in a society with a clear ethnic majority population like the United States, the majority – White Americans – will experience greater life satisfaction than all other ethnic groups, but such ethnic differences in life satisfaction will disappear once the ethnic composition of the immediate environment is controlled. It would also lead us to predict that the statistical effect of ethnic composition on life satisfaction will interact significantly with individual's intelligence.

2. Methods

2.1. Data and participants

We used Wave III data from the National Longitudinal Study of Adolescent Health (Add Health), which consisted of personal interviews held in 2001–2002 with 15,197 individuals aged 18–28 ($M = 21.96$, $SD = 1.77$). The participants were part of a large sample of students originally selected in 1994–1995 (Wave I) from middle and high schools that were representative of US schools with respect to region of country, urbanicity, school size, school type, and ethnicity. For further details of the sampling and study design, see <http://www.cpc.unc.edu/projects/addhealth/design>.

Our sample consisted of 9856 White American respondents, 3263 African American respondents, 1183 Asian American respondents, and 488 Native American respondents. Add Health sampling design oversampled African American respondents; however, we have chosen not to employ Add Health sample weights in the following analyses. Appendix A Table presents descriptive statistics (means and standard deviations) for all variables used in the regression analyses below, for the whole sample as well as by ethnic group.

2.2. Dependent variable: Global life satisfaction

Add Health asked its respondents “How satisfied are you with your life as a whole?”, to which they indicated their response on a five-point Likert scale (reverse coded): 1 = very dissatisfied, 2 = dissatisfied, 3 = neither satisfied nor dissatisfied, 4 = satisfied, 5 = very satisfied. We used this measure of life satisfaction as the dependent variable in our ordinal regression analysis. The mean life satisfaction was 4.15, the median was 4, and standard deviation was .815. These were consistent with all past studies in positive psychology, which showed that “most people are happy” (Diener & Diener, 1996) and that the mean life satisfaction was always significantly above the midpoint of the scale; they were not unique to Add Health. Nevertheless, a ceiling effect and restriction in range could be potential problems.

2.3. Independent variable: Ethnicity

Add Health classified its respondents into four ethnic categories: White, Black/African American, Asian/Pacific Islander, and American Indian/Native American. If respondents listed more than one ethnicity, we classified them in the “one category [that] best describes [their] racial background.”¹

In Add Health, Hispanicity was measured orthogonally to ethnicity; respondents in all ethnic categories could be Hispanic. Preliminary analysis showed that Hispanicity was not associated with global life satisfaction at all, whether in the full sample (Hispanic vs. non-Hispanic: 4.16 vs. 4.15, $t(15,155) = -.705$, $p = .481$) or within each ethnic category (White American: 4.18 vs. 4.20, $t(9847) = .510$, $p = .610$; African American: 3.93 vs. 4.06, $t(3257) = 1.532$, $p = .126$; Asian American: 4.08 vs. 4.09, $t(1180) = .134$, $p = .894$; Native American: 4.14 vs. 4.01, $t(485) = -1.649$, $p = .100$).

¹ Creating a separate category for those respondents who identified with more than one ethnicity did not alter the substantive conclusions below at all. Those who identified as multiethnic also had significantly lower life satisfaction, like those who identified as all other (single) ethnic minorities. Add Health did not measure the proportion of state or county population that was multiethnic so we could not measure the proportion of the population in the same ethnic category as multiethnic respondents. Even if Add Health had measured the proportion of state or country population identified as multiethnic, it would be difficult to match such population proportions with the exact multiethnicity (White/African American, White/Asian American, White/African/Native American, etc.) as the respondent.

2.4. Independent variable: State and county ethnic composition

Add Health measured the proportion of all ethnicities in the state and the county of the respondent’s residence. From this and the respondent’s own ethnicity, we constructed variables that measured the proportion of the state and the county population that was the same ethnicity as the respondent.

2.5. Independent variable: Intelligence

Add Health measured respondents’ intelligence by an abbreviated version of the Peabody Picture Vocabulary Test. Their raw scores were transformed into the standard IQ metric, with a mean of 100 and a standard deviation of 15. The Peabody Picture Vocabulary Test is properly a measure of verbal intelligence. However, verbal intelligence is known to be highly correlated with and thus heavily load on general intelligence (Huang & Hauser, 1998; Miner, 1957; Wolfle, 1980).

2.6. Control variables

In addition, we controlled for the following characteristics of the respondent: Sex (0 = female, 1 = male); Age (in years); Education (in years of formal schooling); and current marital status (1 = currently married, 0 = otherwise). Preliminary analysis showed that the respondent’s earnings had no association with life satisfaction among Add Health respondents ($r = .013$, $p = .116$, $n = 14,414$), perhaps because of their relative youth and little variance in earnings ($M = 11,744$, median = 8000 $SD = 17,289$, $IQR = 16,500$, $n = 14,425$). This was consistent with earlier studies, which showed that variance in earnings generally increased with age (Beach, Finnie, & Gray, 2010; Caswell & Kluge, 2015; Lam & Levison, 1992).

3. Results

The results of the ordinal regression analysis appear in Table 1. Relative to the reference category of White Americans, all ethnic minorities had significantly lower life satisfaction (African American: $b = -.286$; Asian American: $b = -.274$; Native American: $b = -.293$; all $p < .001$). This did not change at all when we controlled for sex, age, education, and current marital status.

However, once we controlled for the proportion of the state population that was the same ethnicity as the respondent, African Americans and Native Americans no longer had lower life satisfaction than White Americans. While the coefficient for the Asian American dummy was still statistically significant ($b = -.184$, $p = .035$), there was significant mediation and the size of the coefficient was much smaller (Sobel test: $z = 2.598$, $p = .009$). The state ethnic composition itself had a marginally significantly positive association with life satisfaction ($b = .190$, $p = .082$).

The results were the same if we controlled for the proportion of the county population that was the same ethnicity as the respondent. African Americans and Native Americans no longer had lower life satisfaction than White Americans, and, while the coefficient for the Asian American dummy was still statistically significant, there was significant mediation (Sobel test: $z = 2.056$, $p = .040$) and the coefficient was much smaller and less significant ($b = -.180$, $p = .020$). The county ethnic composition itself had a statistically significantly positive association with life satisfaction ($b = .195$, $p = .024$).

Fig. 1 shows the statistical effect of county ethnic composition on ethnic differences in life satisfaction. The left panel shows that, in the full sample of Add Health respondents, White Americans had

Table 1
Ethnic differences in life satisfactions.

	(1)	(2)	(3)	(4)	(5)	(6)
Ethnicity						
African American	-.286*** (.037)	-.195*** (.038)	-.079 (.074)	-.090 (.059)	-.070 (.076)	-.112† (.061)
Asian American	-.274*** (.055)	-.308*** (.056)	-.184† (.087)	-.180† (.078)	-.189† (.088)	-.210*** (.079)
Native American	-.293*** (.068)	-.215** (.069)	-.127 (.090)	-.123 (.084)	-.096 (.091)	-.107 (.086)
Sex		.122*** (.031)	.117*** (.032)	.118*** (.032)	.119*** (.033)	.121*** (.033)
Age		-.063*** (.009)	-.058*** (.009)	-.057*** (.009)	-.056*** (.010)	-.056*** (.010)
Education		.147*** (.008)	.149*** (.009)	.150*** (.009)	.154*** (.009)	.154*** (.009)
Currently married		.751*** (.044)	.752*** (.045)	.752*** (.045)	.739*** (.046)	.739*** (.046)
Ethnic composition						
State			.190† (.109)		1.398*** (.323)	
County				.195† (.087)		1.525*** (.304)
Intelligence					.005** (.002)	.006*** (.002)
Intelligence*State ethnic composition					-.012*** (.003)	
Intelligence*County ethnic composition						-.014*** (.003)
Threshold						
Y = 1	-5.221 (.106)	-4.515 (.231)	-4.240 (.254)	-4.204 (.252)	-3.663 (.298)	-3.556 (.298)
Y = 2	-3.263 (.043)	-2.553 (.210)	-2.271 (.234)	-2.235 (.232)	-1.704 (.281)	-1.597 (.281)
Y = 3	-1.715 (.025)	-.987 (.207)	-.712 (.231)	-.677 (.229)	-.146 (.279)	-.038 (.280)
Y = 4	.456 (.020)	1.241 (.207)	1.518 (.232)	1.554 (.230)	2.083 (.280)	2.192 (.280)
Likelihood ratio χ^2	85.735***	617.025***	599.499***	601.530***	590.068***	596.578***
Number of cases	15,102	15,091	14,493	14,493	13,966	13,966

Note: Main entries are unstandardized regression coefficients. (Number in parentheses are standard errors.)

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

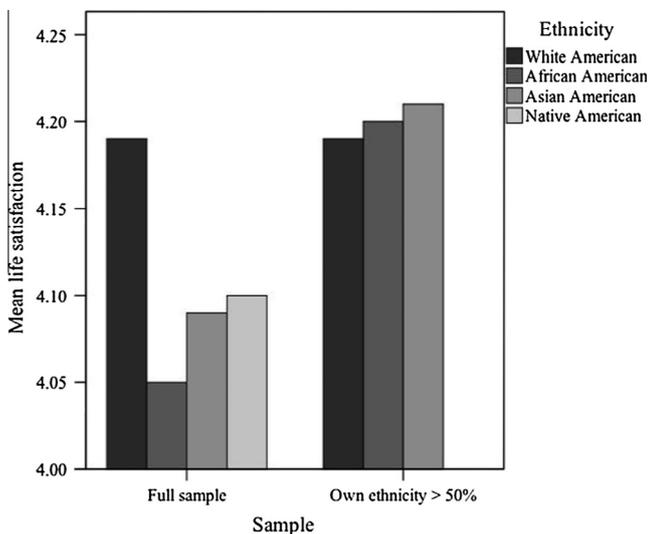


Fig. 1. Mean life satisfaction by county proportion own ethnicity.

significantly higher life satisfaction ($M = 4.19$) than African Americans (4.05), Asian Americans (4.09), and Native Americans (4.10) ($F(3,14,773) = 26.868, p < .001$). Among Add Health

respondents who lived in counties that consisted of 50% or more of their own ethnicity (right panel), however, there were no ethnic differences in life satisfaction ($F(2,9624) = .004, p = .996$). In fact, White Americans ($M = 4.19$) had very slightly (though nonsignificantly) lower life satisfaction than African Americans (4.20) and Asian Americans (4.21). (There were no Native American respondents in Add Health who lived in majority-Native American counties.)²

Further analyses (presented in Columns 5 and 6 of Table 1) showed that, consistent with the prediction, the association between ethnic composition and life satisfaction was significantly stronger among less intelligent individuals than among more intelligent individuals. The interaction term between intelligence and ethnic composition was significantly negative for both state ($b = -.012, p < .001$) and county ($b = -.014, p < .001$).

² There are currently no accepted methods of computing effect sizes or standardized regression coefficients in ordinal regression (and other generalized linear models), partly because the effects of independent variables on the dependent variable in ordinal regression are proportional, not constant. However, the mean differences between ethnicities presented in Fig. 1 allowed us to compute Cohen's d as an estimate for the statistical effect of ethnicity on life satisfaction. Given that the standard deviation of life satisfaction was .815, the mean difference between White and African Americans (-.14) translated to $d = -.17$ for the effect of being African American relative to White American. Similarly, $d = -.12$ for being Asian American, and $d = -.11$ for being Native American.

Fig. 2 presents the statistical interaction effect graphically. Among less intelligent individuals (with a mean IQ of 81.39, one standard deviation below the mean), county ethnic composition had a relatively large association with life satisfaction. Those living in a county with a high (.9102) proportion of own ethnicity indicated greater life satisfaction ($M = 4.192$) than those living in a low (.2816) proportion indicated (4.071). In contrast, among more intelligent individuals (with a mean IQ of 115.57, one standard deviation above the mean), there was a much smaller difference in life satisfaction between those living in a high proportion of their own ethnicity (4.205) and those living in a low proportion (4.174).³

3.1. Comparisons to depression and self-esteem

Wave III of Add Health measured other affective traits besides life satisfaction, such as depression and self-esteem. How do the ethnic differences in life satisfaction that we documented above compare to those in depression and self-esteem?

Add Health measured depression with a single question “Have you ever been diagnosed with depression?” 0 = No, 1 = Yes. Add Health measured self-esteem with a series of six questions, such as “Do you agree or disagree that you have a lot to be proud of?”, “Do you agree or disagree that you like yourself just the way you are?”, and “Do you agree or disagree that you feel you are doing things just about right?” For each question, the respondents could indicate their response on a five-point Likert scale from 1 = strongly disagree to 5 = strongly agree (reverse coded). We extracted a latent factor from these six responses via principal component analysis, and constructed a self-esteem score which has a mean of 0 and a standard deviation of 1.

There were significant ethnic differences in both the prevalence of depression and self-esteem (depression: $F(3,14765) = 69.464$, $p < .001$; self-esteem: $F(3,14724) = 64.874$, $p < .001$). However, the patterns of ethnic differences in depression and self-esteem were completely different from that in life satisfaction. White Americans were far more likely to be diagnosed with depression than any other ethnic group (White American: $M = .13$, $SD = .34$, $n = 9839$; African American: $M = .06$, $SD = .23$, $n = 3261$; Asian American: $M = .04$, $SD = .20$, $n = 1181$; Native American: $M = .07$, $SD = .26$, $n = 488$). It is notable that the ethnic group with the highest mean life satisfaction (White Americans) had the highest prevalence of depression and that with the lowest mean life satisfaction (Asian Americans) had the lowest incidence of depression.⁴

³ Among respondents with low intelligence, the statistical effect of county proportion of ethnicity translated to $d = .15$, whereas, among respondents with high intelligence, it translated to $d = .04$. The statistical effect of county proportion of own ethnicity was therefore nearly four times as large among the less intelligent as among the more intelligent.

⁴ Earlier studies suggested that Asian Americans experienced higher prevalence of depression than White Americans (Okazaki, 1997, 2000). However, these studies used small convenience samples and self-report measures of depression, not a large population sample and a medical diagnosis of depression, as in Add Health. An analysis of another large population sample in the United States (General Social Surveys) also indicated that White Americans were significantly more likely to be medically diagnosed with depression ($M = 18.3\%$) than African Americans ($M = 8.6\%$) or Asian Americans and others ($M = 6.8\%$) ($F(2,1241) = 10.12$, $p < .001$). Controlling for earnings and education strengthened the associations, as individuals with higher earnings were significantly less likely to be medically diagnosed with depression. Net of earnings and education, African Americans ($b = -.960$, $SE = .271$, $p < .001$) and Asian Americans and others ($b = -1.208$, $SE = .360$, $p < .001$) were significantly less likely to be medically diagnosed with depression than White Americans. The fact that White Americans simultaneously have the highest life satisfaction and highest prevalence of depression (and that Asian Americans simultaneously have the lowest life satisfaction and lowest prevalence of depression) seems to suggest either that life satisfaction and (absence of) depression are two independent affective states or that White Americans are more likely to seek medical attention for their depression than are Asian Americans.

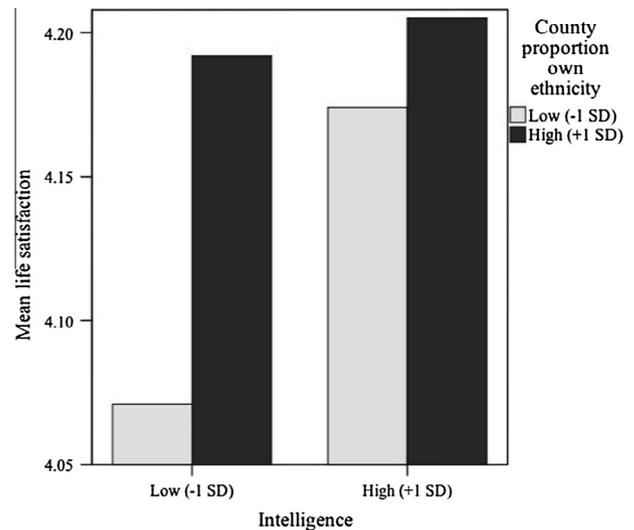


Fig. 2. Interaction effect between intelligence and county ethnic composition on life satisfaction.

Consistent with previous studies (Graham, 1994; Tashakkori & Thompson, 1991), African Americans had a significantly higher mean level of self-esteem than any other ethnic group (White American: $M = -.04$, $SD = .98$, $n = 9813$; African American: $M = .20$, $SD = 1.02$, $n = 3249$; Asian American: $M = -.17$, $SD = 1.04$, $n = 1176$; Native American: $M = -.08$, $SD = 1.01$, $n = 487$). It therefore appeared that the pattern of ethnic differences in life satisfaction that we documented above, where all ethnic minorities had significantly lower levels of life satisfaction than White Americans, and that we partially explained as a function of local ethnic composition, may be unique to life-satisfaction and not shared by other affective traits like depression and self-esteem.

4. Discussion

Consistent with our prediction derived from the Savanna Principle (Kanazawa, 2004), the evolutionary legacy hypothesis (Burnham & Johnson, 2005) and the mismatch hypothesis (Hagen & Hammerstein, 2006), White Americans had statistically significantly greater life satisfaction than African Americans, Asian Americans and Native Americans, but possibly only because they were the majority ethnicity and lived mostly among similar others, as our ancestors did. Once the proportion of own ethnicity in the state or the county of residence was statistically controlled, White Americans no longer had statistically significantly greater life satisfaction than African Americans or Native Americans, and the significant difference with Asian Americans was markedly diminished. Add Health respondents' life satisfaction increased as the proportion of the state and county population in their own ethnic category increased.

Further consistent with recent theoretical advances in evolutionary psychology (Kanazawa, 2010, 2012), the association between ethnic composition and life satisfaction was significantly stronger among less intelligent individuals than among more intelligent individuals. Consistent with the theoretical logic, one possibility is that the observed statistical interaction effect between ethnic composition and intelligence on life satisfaction may stem from less intelligent individuals having had greater difficulty dealing with the evolutionary novelty of living as ethnic minorities and thus might have become less satisfied with life as a result. Further consistent with the theoretical logic, it is possible that more intelligent individuals might have had less difficulty with living among

others of different ethnicities and their life satisfaction might not have been affected as much.

The current study highlighted two important determinants of individual and group differences in life satisfaction – local ethnic composition and intelligence. The importance of the former can potentially explain the repeated findings in positive psychology that ethnic minorities in the United States are often less happy than White Americans (Krause, 1993; Okazaki, 1997; Scollon et al., 2004). Our evolutionary psychological explanation suggests that it is not individuals' ethnicity per se that influences life satisfaction but their majority/minority status. We speculate that ethnic majority individuals in all societies may on average be happier than ethnic minority individuals. The theoretical logic would therefore predict that, for example, even though African Americans and Asian Americans are less happy than White Americans, Blacks may be happier than Whites in Africa, and Asians may be happier than Whites in Asia. These predictions, however, would have to be rigorously tested with appropriate data in future empirical studies.

4.1. Alternative explanations

Given that our data were correlational, it is important to attempt to rule out potential alternative explanations for our empirical results.

4.1.1. Reverse causality

One possibility is that the direction of causality between ethnic composition and life satisfaction is the opposite of what we posit, where happier individuals move to locations where they are in the majority (Motyl, Iyer, Oishi, Trawalter, & Nosek, 2014). This does not appear to be the case, however. While the Wave III measure of life satisfaction was significantly positively correlated with the distance Add Health respondents moved between Waves I and III ($r = .022, p = .008$), the correlation appeared too small to account for the statistical effect of ethnic composition on life satisfaction. Further, while White Americans on average had moved longer distances ($M = 191$ km) than African Americans ($M = 124$ km) or Native Americans ($M = 73$ km), they had moved much less than Asian Americans ($M = 359$ km). Because Asian Americans had the lowest mean level of life satisfaction, it did not appear that individuals with greater life satisfaction moved closer to others of the same ethnicity. Adding the distance moved to the models presented in Columns 5 and 6 in Table 1 did not alter the substantive conclusion at all; net of other variables, the distance moved was not significantly associated with life satisfaction.

4.1.2. Prejudice and discrimination

Another alternative interpretation of our results is that ethnic minorities face greater prejudice and discrimination when their numbers are smaller, which reduces their life satisfaction. In Add Health, subjective measures of prejudice were available only for Waves I and II, when the respondents were adolescents, with the question: "How much do you agree or disagree with the following: Students at your school are prejudiced." 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree (reverse coded). A measure of subjective perception of prejudice was not available for Wave III.

Controlling for the subjective perception of prejudice in Waves I and II did not alter the overall empirical picture at all. While, quite predictably, subjective perception of prejudice during adolescence significantly decreased life satisfaction in early adulthood in all equations, the statistical effect of ethnic composition and the interaction effect between intelligence and ethnic composition on life satisfaction largely remained significant (state ethnic composition: $b = .191, p = .083$ with Wave I prejudice controlled; $b = .290,$

$p = .026$ with Wave II prejudice controlled; county ethnic composition: $b = .170, p = .053$ with Wave I prejudice controlled; $b = .163, p = .119$ with Wave II prejudice controlled; interaction between intelligence and state ethnic composition: $b = -.013, p < .001$ with Wave I prejudice controlled; $b = -.008, p = .033$ with Wave II prejudice controlled; interaction between intelligence and county ethnic composition: $b = -.014, p < .001$ with Wave I prejudice controlled; $b = -.010, p = .006$ with Wave II prejudice controlled). Subjective perception of prejudice significantly mediated the statistical effect of ethnic composition and the interaction effect of intelligence and ethnic composition only in half the equations in Table 1, and did not at all mediate them in the other half. Subjective perception of prejudice, while another important determinant of life satisfaction, therefore did not appear to explain the effects of ethnic composition and intelligence on life satisfaction that we reported above.

4.1.3. Big Five personality factors

Life satisfaction is associated with Big Five and other personality factors (DeNeve & Cooper, 1998; Diener, Oishi, & Lucas, 2003). If there are ethnic differences in the prevalence of different personality types known to be associated with life satisfaction, then it can explain the ethnic differences in life satisfaction that we reported above.

In Add Health, Big Five personality factors were measured only in Wave IV, after our dependent variable (life satisfaction) was measured in Wave III. However, personality psychologists generally concur that individual personality, including the Big Five, remains largely constant throughout the life course, although there are some individual differences in its stability (Mroczek & Spiro, 2005). One of the major influences on changes over time is age (Roberts & DelVecchio, 2000), which is held constant in longitudinal cohort data like Add Health. So we assumed that Add Health respondents' scores on the Big Five measured in Wave IV were largely representative of their personality earlier in their lives. Add Health measured Big Five personality factors with four five-point Likert scales for each factor, each score thus ranging from 4 to 20.

Ethnic differences in Big Five scores were statistically significant in one-way ANOVA (Openness: $F(3,12640) = 5.535$; Conscientiousness: $F(3,12697) = 10.404$; Extraversion: $F(3,12698) = 18.849$; Agreeableness: $F(3,12697) = 17.539$; Neuroticism: $F(3,12698) = 14.407$, all $p < .001$). However, the ethnic differences in life satisfaction remained significant even after Big Five personality factors were statistically controlled (African American: $b = -.274$; Asian American: $b = -.355$; Native American: $b = -.278$, all $p < .001$). Thus ethnic differences in personality factors did not explain the ethnic differences in life satisfaction. As predicted, net of ethnicity, all Big Five personality factors were significantly associated with life satisfaction (Openness: $b = -.039, p < .001$; Conscientiousness: $b = .048, p < .001$; Extraversion: $b = .036, p < .001$; Agreeableness: $b = .015, p = .054$; Neuroticism: $b = -.138, p < .001$).

4.1.4. Immigration status and acculturation

First- and second-generation immigrants often face difficult processes of acculturation and assimilation, which may reduce their life satisfaction in the host country (Sam & Berry, 2010; Schwartz et al., 2013). In addition, otherwise difficult tasks of acculturation and assimilation into the larger, ethnic-majority society may become easier if they live among others of the same cultural backgrounds. Thus, if ethnic groups differ in the probability that they are first- or second-generation immigrants, then it can potentially explain both the ethnic differences in life satisfaction and the effect of ethnic composition on life satisfaction.

Add Health measured whether the respondents themselves, their mother, and their father were born outside of the United States. There were significant ethnic differences in the

respondents' and their parents' immigration status (respondent: $F(3,14783) = 784.323$; mother: $F(3,14684) = 1407.667$; father: $F(3,14023) = 1426.468$; all $p < .001$); Asian American and Native American respondents and their parents were significantly more likely to have been born outside the United States than White American and African American respondents and their parents.⁵ However, controlling for the respondent and parental immigration status did not at all attenuate the ethnic differences in life satisfaction (African American: $b = -.265$; Asian American: $b = -.272$; Native American: $b = -.300$; all $p < .001$). Immigration status was not at all associated with life satisfaction (respondent: $b = .105$, $p = .139$; mother: $b = .008$, $p = .912$; father: $b = -.093$, $p = .163$). Thus ethnic differences in immigration status did not explain the ethnic differences in life satisfaction.

4.1.5. Self-determination and mastery

Self-determination theory (Ryan & Deci, 2000), and, in particular, its component theory, basic psychological needs theory (Deci & Ryan, 2002), suggest that humans have basic psychological needs such as autonomy, competence, and relatedness, and their satisfaction leads to greater psychological well-being. If ethnic groups differ in the extent to which they satisfy such basic psychological needs, then that can explain the ethnic differences in life satisfaction.

Add Health measured mastery only in Wave IV, thus the earlier caveat about the dependent variable having been measured prior to the independent variable, and the justification in terms of stable personality factors, apply here as well. Add Health measured autonomy, competence, and relatedness with five five-point Likert scale items, such as "There is little I can do to change the important things in my life," "Other people determine most of what I can and cannot do," and "There are many things that interfere with what I want to do" (all reverse coded). It combined these responses into one "mastery" scale which varied from 5 to 25. Ethnic groups did not significantly differ on mastery ($F(3,12679) = 1.580$, $p = .192$). As a result, while mastery itself was significantly positively associated with life satisfaction ($b = .102$, $p < .001$), controlling for it did not at all alter the ethnic differences in life satisfaction (African American: $b = -.302$; Asian American: $b = -.299$; Native American: $b = -.282$; all $p < .001$).

4.1.6. Unemployment and crime rates

Another possibility is that the association between ethnic composition and life satisfaction is confounded with other features of the geographic location, such as unemployment or crime rates. Add Health measured unemployment rates at the county and state levels in Wave III as the proportion of all persons 16 years and over who were unemployed and crime rates at the county level in Wave III as the total number of adults arrested for all crimes per 100,000 inhabitants.

Life satisfaction was statistically significantly, though very weakly, negatively correlated with state (though *not* county) unemployment rate and crime rate (county unemployment: $r = .001$, $p = .943$, $n = 14,877$; state unemployment: $r = -.024$, $p = .004$, $n = 14,877$; crime: $r = -.021$, $p = .013$, $n = 14,436$). However, controlling for unemployment and crime rates did not at all attenuate the ethnic differences in life satisfaction in the manner that ethnic composition did (county unemployment: African American $b = -.327$; Asian American $b = -.284$; Native

American $b = -.325$; state unemployment: African American $b = -.287$; Asian American $b = -.262$; Native American $b = -.301$; crime: African American $b = -.290$; Asian American $b = -.274$; Native American $b = -.298$; all $p < .001$). Interestingly, net of ethnicity, county unemployment rate had a significantly *positive* association with life satisfaction ($b = 2.486$, $p < .001$); state unemployment and crime rates were not significantly associated with life satisfaction net of ethnicity (state unemployment: $b = -1.505$, $p = .382$; crime: $b = .000$, $p = .728$).

4.1.7. Social and cultural factors

There may also be social and cultural reasons that ethnic minorities may have lower average levels of life satisfaction than White Americans. These factors are unlikely to explain our empirical findings, however. First, it is difficult to think of social and cultural factors that are shared by African Americans, Asian Americans, and Native Americans *but not* by White Americans (except for their numerical minority status). Second, it is not clear why such social and cultural factors cease to depress minority life satisfaction when they live in counties and states in which they are the numerical majority. Third, and most important, social and cultural explanations for ethnic differences in life satisfaction would have difficulty accounting for the interaction with general intelligence predicted by our evolutionary perspective and supported by our empirical results.

4.1.8. Genetic factors

There is some evidence that genes partially influence subjective well-being and may account for the national differences in happiness (De Neve, Christakis, Fowler, & Frey, 2012; Proto & Oswald, 2014; Rice & Steele, 2004). For example, numerous studies show that Asians tend to have lower levels of life satisfaction than others, not only within the United States (Okazaki, 2000; Okazaki, Liu, Longworth, & Minn, 2002; Scollon et al., 2004) but internationally as well (Diener, Diener, & Diener, 1995; Diener, Scollon, Oishi, Dzokoto, & Suh, 2000; Scollon et al., 2004). In one comparison of 55 nations on the average subjective well-being, relatively ethnically homogeneous Asian nations of China, South Korea, and Japan ranked 53rd, 48th, and 42nd, respectively, much lower than ethnically heterogeneous nations of the US (7th), United Kingdom (14th), and Brazil (17th) (Diener et al., 1995).

Given the current evidence, there is no doubt that genetic factors account for at least some of the ethnic differences in life satisfaction we found, especially the fact that Asian Americans in the Add Health sample remained significantly lower in their life satisfaction even after the ethnic composition of their state and county was statistically controlled. However, the genetic differences cannot explain the fact that African Americans and Native Americans were no longer significantly lower in their life satisfaction after ethnic composition was controlled, nor the fact that ethnic composition significantly mediated Asian Americans' level of life satisfaction. We believe that both genetic factors and ethnic composition independently contribute to individual levels of life satisfaction. This is an area that requires further theoretical and empirical development.

4.2. Limitations and future directions

A major limitation of our study is the small effect sizes in the ethnic differences in life satisfaction. While the effect sizes we report are small by the standards of experimental psychology (Cohen, 1992), which relies on direct manipulations of independent variables in controlled experiments, their magnitudes are reasonable by the standards of survey research. (See De Neve et al. (2012) as an example of a non-experimental study that uses the same dependent variable from the same survey data that we used

⁵ It may at first sound strange that Native American respondents and their parents were significantly more likely to have been born outside the United States than White American and African American respondents and their parents. Upon closer inspection, however, this was because an overwhelming majority (>82%) of "Native American" immigrants were from Central and Latin America, with both Native American and Hispanic backgrounds.

here.) It is notable that any statistically significant ethnic differences in life satisfaction were observed in survey data on a representative population sample and further that they entirely disappeared or were significantly attenuated once *only one* variable was introduced in the multiple regression equation. However, we emphasize the preliminary nature of our findings and small effect sizes found, and call for extreme caution in interpreting our results, especially given the use of correlational survey data. Future studies will have to test our evolutionary psychological hypothesis with rigorous experimental data.

Another potential limitation of our study is that, despite its prospectively longitudinal design, Add Health measured life satisfaction only once in Wave III, when the respondents were in their early adulthood. However, it is not immediately obvious to what extent this limitation affects the generalizability of our findings. On the one hand, individual differences in life satisfaction are known to be relatively stable over the life course, because individuals tend to have a baseline “happiness set-point,” to which they return after major life events, both positive and negative (Headey & Wearing, 1989). And one of the major factors that influence long-term changes in life satisfaction is age (Blanchflower & Oswald, 2008). Strictly speaking, if individual traits either stay invariant across time and/or follow invariant life-course trajectories, then longitudinal cohort data and repeated measurements are not necessary and one can generalize from a single measurement at a time (Gottfredson & Hirschi, 1986). On the other hand, however, individual happiness “set-points” can shift over time (Diener, Lucas, & Scollon, 2006; Fujita & Diener, 2005) and the life-course trajectories of life satisfaction can vary across individuals (Mroczek & Spiro, 2005). Future studies in this area must employ repeated measures of life satisfaction in a prospectively longitudinal sample to explore the stability and change in the association between ethnic minority status and life satisfaction.

While we have focused – theoretically and empirically – on ethnicity in this paper, it is possible that the key environmental factor affecting life satisfaction is a more general one of *similarity*. Our ancestors lived in groups where other members were not only of the same ethnicity but were also similar in many other dimensions, so it is possible that individuals become more satisfied with life to the extent that they live among *similar* others, not just others of the same ethnicity. For example, are Democrats happier living in majority-Democrat districts than in majority-Republican districts, and vice versa? There are other potential issues to ponder. For instance, even though Hispanicity was not associated with life satisfaction in the Add Health data, should Hispanics be treated as a separate ethnicity in future tests of our hypothesis? Does the effect of ethnic homogeneity on life satisfaction interact with the strength of ethnic identification or the salience of ethnicity? How does the process affect multiethnic individuals? Our study raises a host of questions and considerations for future research in positive psychology.

Our findings and evolutionary psychological explanation for them also suggest possible means for improving minority life satisfaction. A potentially fruitful avenue is to study members of ethnic groups who are quite satisfied with life despite their minority status. Similarly, it may be insightful to explore proximate mechanisms or behavioral strategies that mediate the link between general intelligence and the ability to adapt to evolutionarily novel circumstances. For example, more intelligent individuals may make greater use of modern technology to keep connected with members of their ethnic group or have better techniques for assimilation into mainstream society. Uncovering key factors would allow interventions to be designed for improving the life satisfaction of minorities who live in ethnic isolation in the US and internationally.

The fundamental premise of our theory concerns evolutionary mismatch – that the human brain has difficulty comprehending and dealing with entities and situations that did not exist in the ancestral environment. Thus one may potentially exploit such evolutionary limitations of the human brain to increase life satisfaction. For example, because realistic images of other humans, such as movies, videos and pictures, did not exist in the ancestral environment, humans implicitly assume that characters they regularly see on TV are their personal friends (Derrick, Gabriel, & Hugenberg, 2009; Gardner & Knowles, 2008; Kanazawa, 2002). This suggests that people’s perceptions of themselves as minorities could be influenced by the TV shows they watch. In particular, by watching shows that feature members of their own ethnic groups, individuals may perceive themselves less as ethnic minorities and could potentially become more satisfied with life.

At the same time, new video communication technologies such as Skype and FaceTime allow physically disconnected individuals to see and communicate with each other in real time. The evolutionary constraints on the brain could lead users to feel that they are in the actual physical presence of their friends and family far-away, which may increase their life satisfaction.

It goes without saying that ours is an explanatory theory in basic science, which aims to identify causal factors in life satisfaction, and to account for individual differences in them. It is emphatically *not* a prescription for life. In particular, we are decidedly *not* advocating that individuals move to counties and states where they are ethnic majorities. Our conclusion is in no way a justification or endorsement of ethnic integration or segregation.

5. Conclusion

The current study is the first in identifying conditions in the ancestral environment as key contributors to life satisfaction. The findings highlight important factors related to minority life satisfaction and, more broadly, suggest that an integration of evolutionary psychology and positive psychology may be fruitful.

Appendix A

Descriptive statistics

	Full sample	By ethnicity			
		White American	African American	Asian American	Native American
Life satisfaction	4.15	4.19	4.05	4.09	4.10
	(.82)	(.79)	(.88)	(.79)	(.85)
African American	.23	.00	1.00	.01	.02

Appendix A (continued)

	Full sample	By ethnicity			
		White American	African American	Asian American	Native American
	(.42)	(.06)	(.00)	(.07)	(.13)
Asian American	.08	.01	.00	1.00	.01
	(.28)	(.08)	(.02)	(.00)	(.08)
Native American	.05	.03	.00	.01	1.00
	(.23)	(.16)	(.02)	(.08)	(.00)
Sex	.49	.48	.44	.52	.52
	(.50)	(.50)	(.50)	(.50)	(.50)
Age	21.96	21.92	21.88	22.32	22.18
	(1.77)	(1.76)	(1.80)	(1.71)	(1.79)
Education	13.19	13.21	12.97	13.94	12.44
	(1.97)	(1.98)	(1.87)	(1.98)	(1.81)
Currently married	.17	.20	.10	.12	.19
	(.38)	(.40)	(.30)	(.32)	(.39)
State ethnic composition	.56	.77	.18	.13	.01
	(.31)	(.11)	(.10)	(.14)	(.01)
County ethnic composition	.60	.78	.27	.14	.01
	(.31)	(.15)	(.18)	(.13)	(.02)
Intelligence	98.48	102.28	89.63	95.36	89.11
	(17.09)	(12.74)	(21.13)	(22.86)	(21.77)

Note: Main entries are means.

(Numbers in parentheses are standard deviations.)

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