Life satisfaction in the new country: a multilevel longitudinal analysis of effects of culture and 5-HTT allele frequency distribution in country of origin

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Life satisfaction of migrants to Australia from 17 countries, assessed at 4-5 months, 16-17 months and 3½ years after arrival, was analyzed with a longitudinal, multilevel analysis. The results indicated that migrants were more satisfied, if the national average life satisfaction was higher in their country of origin, after adjustment for individual-level income, age, and sex and a linear temporal trend. Simultaneously, the migrants were also happier if people in their country of origin had a higher frequency of 5-HTT long allele, a genotype known to be associated with resilience under life stresses. These two relationships were independent, suggesting that both culture and gene matter in international transitions.

Keywords: culture-gene co-evolution; migrants; life satisfaction; serotonin transporter gene

INTRODUCTION

Migration is ubiquitous in human history. Since modern humans first migrated out of Africa more than 60,000 years ago, our ancestors slowly but surely populated nearly the entire surface of our planet. Contemporary people continue to migrate from one geographical region to another, across political and cultural boundaries. Indeed, the number of international migrants continued to rise in the 20th century and the trend is expected to maintain in this century (Koser and Laczko, 2010). Thus, how individuals survive and thrive through changing life circumstances due to migration is an important question. This article addresses this issue by focusing on migrant life satisfaction (MLS) in the new country. Personal and societal factors that affect migrant adaptation are well documented (Berry, 1990; Diener, 2000). However, two additional factors that have received relatively little attention are culture—the ideas and practices shared by a group of migrants—and genes, which tend to be shared by migrants from the same region. We submit that migrants' satisfaction with life in the new country may be associated with both culture and genes.

Gene-culture co-evolution, culture-level life satisfaction and MLS

Despite the long-standing nature versus nurture debate, the current consensus is that genotypes and culture coevolve in the environment. Although the natural environment (e.g., climate, natural disasters, pathogen prevalence) and the human-made circumstances (e.g., intergroup relations, economic condition) present challenges, both genetically transmitted information (i.e., genotypes) and socially transmitted information (i.e., cultural ideas and practices) provide means by which human populations can adapt (Lumsden and Wilson, 1981; Boyd and Richerson, 1985, 1990; Durham, 1991). Arguably, one potential index of adaptation by these human populations (cultural groups, hereafter) given the eco-social niches that they occupy is culture-level life satisfaction. By this, we mean average levels of satisfaction with general life circumstances (Suh et al., 1996; Diener, 2000) exhibited by cultural groups (typically treating countries as cultural groups), which are relatively stable across time and measurement scales used (Diener et al., 2013). The gene-culture coevolutionary perspective thus suggests that culture-level life satisfaction is a complex function of the prevalence of genotypes as well as cultural ideas and practices, in interaction with the eco-social niche of the cultural groups.

This view can be extended to migrants' life satisfaction in their host country. As individuals opt to leave their cultural group of origin and migrate to a new country they take their genetic and cultural inheritance with them. The genetic and cultural makeup of the migrants endows them with resources with which they adapt to their new life circumstances. Recent research in subjective well-being and genetic factors in life satisfaction provides insights into how cultural and genetic factors contribute to MLS.

First, the culture-level life satisfaction of a migrant's heritage culture [or NALS (national average life satisfaction)] can act as a 'base level' to which his or her life satisfaction tends to return after positive or negative life events (Brickman and Campbell, 1971; Headey and Wearing, 1989). The tendency to return to a base level can be considered as a kind of attractor dynamics within a complex psychological system of life satisfaction and emotion regulation (Kuppens et al., 2010). Rice and Steele (2004) for instance reported that migrant groups can maintain a certain level of well-being across generations. Thus, migrants travel to another country with a propensity to be more or less satisfied with their new life commensurate with their original country's NALS. Presumably, various cultural ideas and practices available in their heritage culture (e.g., emotion regulation strategies; Murata et al., 2013) allow them to maintain their NALS.

Research also suggests that MLS would be influenced by their genetic inheritance. In particular, allelic variants of the serotonin transporter-linked polymorphic region (5-HTT) have been shown to moderate the impact of stress on mental health (Karg et al., 2011). Higher levels of stressful life events are more likely to lead to depressive symptoms, diagnosable depression, and suicidality among individuals with one or two copies of the short (S) allele of the 5-HTT promoter than those homozygous for the long (L) allele (Caspi et al., 2003; Karg et al., 2011 for meta-analysis). Consistent with this view, those homozygous for the S allele produce higher and more prolonged elevation of cortisol in response to stressors than those with an L allele (Gotlib et al., 2008). Further, De Neve (2011) found with a nationally representative sample that young Americans who are homozygous for the L...
allele had higher levels of life satisfaction than those who are heterozygous, who were in turn more satisfied than those homozygous for the S allele. A subsequent study by De Neve et al. (2012) however failed to replicate this result. This may be related to the fact that De Neve’s analyses did not take stressors into account.

If 5-HTT genotypic variations can relate to life satisfaction in general, then this relationship would be more likely manifested among migrants, who typically face a higher level of stress due to their life circumstances that require adjustment in relative social isolation (Sam et al., 2008). Given that the 5-HTT long allele frequency in migrants’ country of origin is a reasonable indicator of the likelihood that a migrant from that country has a 5-HTT long allele, the 5-HTT long allele frequency of a migrant’s country of origin, along with NALS, may predict his or her level of life satisfaction after migration.

Nevertheless, it is difficult to predict the time course of cultural and genotypic effects on MLS. One scenario is that all migrants face major stresses immediately after their arrival, showing similar levels of low life satisfaction initially, but their cultural and genotypic resources begin to show their effects later, so that those who have certain cultural and genotypic proclivities cope better and show higher levels of life satisfaction. Another scenario is that cultural and genotypic resources have an immediate effect, but learning of new cultural ideas and practices improve their life satisfactions over time, eventually showing no effects of cultural or genotypic backgrounds. Finally, it is possible that cultural and genotypic effects are relatively stable over the time course of settlement. In this case, the cultural and genotypic effects on life satisfaction largely represent the general inclinations to experience positive or negative emotions (Surguladze et al., 2008), or efficiency in implicit and explicit emotion regulation (Koole and Rothermund, 2011), or both. These processes may be, in part, culturally transmitted: for instance, they are learned early through socialization and maintained lifelong.

Genotype and cultural pattern: how do they relate with each other?

From a gene-culture coevolutionary perspective, we have thus far outlined the reasoning behind our predictions that the NALS and 5-HTT long allele prevalence of the migrant’s culture of origin may affect his or her long-term trajectory of life satisfaction. It is important, however, to consider one issue in empirically examining these hypotheses. The complex relations between genotypic frequency and cultural patterns may confound our attempts to investigate the joint effects of culture and genotype on migrant adaptation.

One of the most significant cultural patterns requiring attention is individualism and collectivism. Chiao and Blizinsky (2010), in their groundbreaking work on gene-culture relations, proposed that 5-HTT polymorphism and individualism-collectivism may have coevolved as distinct genetic and cultural responses to the environment. They showed that 5-HTT long allele genotypes tend to be more prevalent in individualist cultures, whereas short allele genotypes are more prevalent in collectivist cultures. They argued that collectivist culture provided short-allele carriers with adaptive benefits against affective disorders due to psychological protection rendered by a close-knit ingroup. This implies that migrants from collectivist cultures with higher short allele frequencies may be more vulnerable to acculturative stresses and lower well-being when they leave their social support group behind.

Another recent study from a culture-gene coevolutionary view has found that 5-HTT short allele prevalence was associated with the orientation towards hierarchical dominance in countries faced a high level of territorial and resource threats (Fischer, 2013). In this view, greater cultural importance placed on hierarchy and mastery values is associated with 5-HTT short allele prevalence, especially when cultural groups are under stress. In a related vein, Mrazek et al. (2013) reported that 5-HTT short allele prevalence is associated with cultural tightness, a system of strong norms and sanction against norm violation thought to develop as a cultural adaptation to socioecological threats (Gelfand et al., 2011).

These findings suggest that cultural patterns of collectivism, hierarchy, mastery and cultural tightness are potentially associated with 5-HTT short allele prevalence in a cultural group. Provided that allelic frequency of 5-HTT in migrants’ cultures of origin may affect their life satisfaction, these cultural factors too need to be investigated as potential cultural influences on their life satisfaction.

Life satisfaction and affective disorders as studied by Chiao and Blizinsky (2010) are related, both conceptually and empirically. Life satisfaction is often considered as a cognitive component of subjective well-being together with positive affect and (lack of) negative affect (Diener, 1994). Also, the relationship between low life satisfaction and depression has been demonstrated at both the individual and national levels (van Hemert et al., 2002). Nevertheless, well-being is not simply absent of affective disorders, and therefore, these different aspects of psychological adaptation need to be investigated separately.

Present study

MLS may be affected by cultural and genotypic characteristics of their countries of origin. Migrants from higher NALS and greater 5-HTT long allele prevalence are likely to report higher levels of life satisfaction although these cultural and genotypic effects may vary over time. Nonetheless, these characteristics of their culture of origin may be also confounded with individualism, hierarchy, mastery, and cultural tightness. To address these questions, we examined the level of life satisfaction reported at three different times (4–5 months, 16–17 months and 3½ years after migration) by migrants to Australia from 17 different countries and regions whose relevant culture-level indicators (i.e. NALS, 5-HTT long allele prevalence (L%), individualism, hierarchy, mastery, and tightness) are known.

METHOD

Sample

The Longitudinal Survey of Immigrants to Australia (LSIA) data published by the Department of Immigration and Multicultural and Indigenous Affairs were analyzed. Participants were a stratified random sample of all migrants granted an offshore visa to Australia between September 1993 and August 1995, and comprised 7% of all immigrants during the period (see http://www.immi.gov.au/media/research/lsia/lsia05.htm for details). Interviews were conducted three times: 4–5 months after arrival (T1), 16–17 months after arrival (T2), and approximately 3½ years after arrival (T3). We analyzed data of 1360 respondents from 17 countries/regions: United Kingdom, Italy, Germany, ‘Other Western Europe’ (mostly from Austria, France, and the Netherlands), Northern Europe (Denmark, Finland, Norway, and Sweden), Poland, Russia, Turkey, Singapore, China, Japan, South Korea, Taiwan, India, U.S.A., Argentina, South Africa. Cultural tightness data were available for 14 of these 17 countries (except Argentina, Russia, and South Africa); consequently, analyses involving tightness were limited to 1167 respondents from 14 countries. The scores of culture-level indices are shown in Supplementary Table 1.

Measures

MLS In Australia

Migrants’ satisfaction with life in Australia was assessed by a single-item question ‘All things considered, how do you feel about your life in...
Australia? One answer was selected from 1 ‘very dissatisfied,’ 2 ‘dis-
satisfied,’ 3 ‘neither satisfied nor dissatisfied,’ 4 ‘satisfied,’ and 5 ‘very
satisfied’. The reliability of single-item scales of life satisfaction has
been estimated to be between 0.50 (Schimmack and Oishi, 2005)
and 0.72 (Lucas and Donnellan, 2011). Moreover, this type of scale
successfully captures the changes in life satisfaction due to specific life
events such as childbirth and widowhood, and the return to the per-
son’s former level of satisfaction (Diener et al., 2013).

**Individual-level factors**

Gender was coded as 0 ‘male’ and 1 ‘female’; marital status as 0 ‘not
married’ and 1 ‘married’. English language skills in speaking, reading
and writing were assessed by three questions (e.g. ‘How well would you
say you speak English?’ 1 = ‘not at all’, 2 = ‘not well’, 3 = ‘well’ and
4 = ‘very well’). They were averaged and the scale was centered. Weekly
income was selected from 14 levels with the lowest level being ‘no
income’. The scale was centered.

**Genotype: 5-HTT long allele frequency**

The genetic data were obtained from Chiao and Blizinsky (2010) who
estimated the 5-HTT short allele frequency in 31 countries, based on
124 peer-reviewed publications involving 50,135 individuals (the genet-
ic database hereafter). Of the 31 countries 17 overlapped with coun-
tries/regions of origin in LSIA. We analyzed long allele frequency
because of its expected, positive relation with life satisfaction for ease
of exposition.

**NALS**

NALS was adopted from the Word Database of Happiness (http://
worlddatabaseofhappiness.eur.nl/hap_nat/findingreports/RankReport_
AverageHappiness.php#technicaldetail; Veenhoven, 2013). These data
were based on national surveys conducted between 2000 and 2009 in
numerous nations by using the same question ‘All things considered,
how satisfied or dissatisfied are you with your life as a whole these days?’
and rated on an 11-point scale ranging from 0 ‘not satisfied’ to 10 ‘very
satisfied’. Strong evidence for the validity of the scale has been provided
in prior research (Diener et al., 2013). For example, using this type of
scale, the average life satisfaction in nations has been found to correlate
with civil and political rights, political freedom, and GDP per capita.

**Other cultural factors**

Hofstede’s individualism index (Hofstede, 1980, 2001) was used to
gauge individualism as in Chiao and Blizinski (2010). Schwartz’s
(1994) hierarchy and mastery values were used for hierarchical dom-
inance orientation (Fischer, 2013). Tightness was based on Gelfand
et al. (2011).

**RESULTS**

**Culture-level indicators**

Culture-level factors were correlated across 17 countries. As in previ-
ous research, long allele frequency (L%) positively correlated with in-
dividualism (0.74**, P < 0.01) and negatively correlated with hierarchy
(−0.56*, P < 0.05), mastery (−0.60*) and tightness (−0.70**). L% and
NALS were not significantly correlated (0.21). It is noteworthy that
NALS also correlated with individualism (0.51*), hierarchy (−0.70**) and
tightness (−0.69**). These results suggest that culture-level factors
need to be controlled. For all correlation of culture-level factors, see
Supplementary Table 2.

**Multi-level analysis of MLS**

The data set has a 3-level nested structure: time points at level 1, migrants at level 2, and country of origin at level 3. MLwiN Version
2.1 (Rasbash et al., 2009) was used for all analyses. As typically in model
testing approaches, predictions are tested by comparing the relative fit of
the two nested models. When the new predictor significantly re-
duces the model’s $-2 \times \log$ likelihood ratio (LR) this will be taken as
supportive evidence for the predicted association between the pre-
dictor and MLS.

**Preliminary analyses**

A variance components model was run to separate the variance in MLS
into three levels. The result indicated that 5% of the variance was due
to country-level variability, 33% was due to personal variability, and
the remaining 62% was due to temporal variability. Thus, the largest
amount of variance in MLS was associated with systematic and
random changes over time.

MLS was generally high, and increased slightly from T1 (M = 4.22,
s.d. = 0.72), T2 (4.25, 0.66) to T3 (4.27, 0.65). When a model with the
linear trend over three time points (dummy coded as −1, 0, 1) was
compared to the variance components model, the reduction in LR was
significant, $\chi^2 = 5.2, P < 0.05$. Adding a quadratic trend did not im-
prove prediction ($\chi^2 = 0.13, P > 0.05$), and therefore only the linear
trend was included in further analyses.1

The effects of individual difference variables (sex, age, income, mar-
tal status and English skills) were examined. The slopes of these vari-
ables were homogenous across countries, and consequently they were
fixed. Only income was found to be significant ($\beta = 0.018, SE = 0.003,
P < 0.001$). As might be expected, migrants with higher income were
more satisfied with their life in Australia. To be cautious, however, sex
and age as well as income were controlled in subsequent analyses.

A random intercept model with the linear time trend, sex, age and
income in the fixed part, and the country-level, individual-level, and
time-level variances in the random part, will be referred to as the base-
model. The base model had the LR of 7566.8.

**Testing predictions**

First, L% was added to the base-model. A significant reduction in LR
supported the association between L% and MLS, $\chi^2 = 12.11, P < 0.001$.
Migrants from countries with greater prevalence of 5-HTT long allele
genotype tend to be more satisfied with life in Australia. Moreover,
when Time × L% interaction was added to the model, the effect was
also significant, $\chi^2 = 7.15, P < 0.01$. The pattern of interaction sug-
gested that migrants from high L% countries became more satisfied
over time, whereas those from low L% countries maintained a similar
level of life satisfaction throughout (Figure 1).

To test the effect of NALS on individual migrant’s life satisfaction,
NALS was added to the base model (without L% or Time × L% in-
teraction). NALS was positively and significantly associated with MLS,
$\chi^2 = 6.50, P < 0.05$. As expected, migrants from countries with higher
NALS tend to be satisfied with their life in Australia as a whole. This
tendency was temporally invariant as evidenced by non-significant
Time × NALS interaction (P > 0.05) (see Supplementary Table 3).

So far it has been shown that NALS as well as L% and the latter’s
interaction with time had a significant relationship with MLS. To test
the main hypothesis that both cultural and genotypic makeup of mi-
grants affects their life satisfaction, we constructed a model that adds
NALS to the model that already contains L% and the L% × Time

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1 Because the data were collected 4–5 months, 16–17 months, and 3.5 years after arrival, we also fitted a time
trend of 4.5, 16.5, and 42, instead of −1, 0, and 1. All analyses were repeated. The results led to the same
conclusion.
interact. The result indicated a significant reduction in the value of LR ($\chi^2 = 8.05, P < 0.01$). Moreover, all three regression weights were significant: NALS ($P < 0.01$), L% ($P < 0.001$), and L% x Time ($P < 0.01$). Thus, both genotypic (long allele prevalence) and cultural (NALS) factors were independently associated with greater MLS. The remaining country-level variance in MLS diminished to less than 1%, and was no longer significant, suggesting that a combination of long allele frequency and NALS explained most of its variance.

We examined whether other culture-level factors predict MLS beyond the model just described. Preliminary analyses have shown a significant main effect when each cultural factor was added to the base model: Individualism ($\chi^2 = 9.52, P < 0.01$), High NALS ($8.92^{**}$), Mastery ($6.49^{*}$) and Tightness ($6.32^{*}$). A significant Individualism x Time interaction effect was also found ($6.5^{*}$). None of these factors remained significant ($P > 0.05$) when they were included in the model that already had NALS, L%, and L% x Time. More details are available in Supplementary Tables 4 and 5.

Finally, we also examined whether MLS was related to other country-level variables such as GDP per capita and civil/political rights, since previous research has found them to be correlated with culture-level life satisfaction (Diener et al., 2013). None were found to be significant.

**DISCUSSION**

Both cultural and genotypic factors contribute to migrants’ life satisfaction. Migrants from countries with higher NALS and greater prevalence of 5-HTT long allele genotype tend to be more satisfied with their life in Australia soon after their settlement. Although the effect of the cultural factor was relatively stable over 3.5 years, the genotypic effect increased with time. Those from countries with greater 5-HTT long allele prevalence became more satisfied whereas those from countries with lower prevalence of 5-HTT long allele remained stable. This is intriguing in light of the non-significant association between NALS and 5-HTT long allele prevalence. As stress level is expected to be high among international migrants (Bhagat and London, 1999; Nicholson et al., 2013), it seems to imply that the genotypic proclivity to maintain relatively stable life satisfaction (i.e. short allele) and the contrasting tendency to keep enhancing life satisfaction (i.e. long allele) emerge when migrants are exposed to long-term stressors. These results are consistent with the dominant view that 5-HTT variants have their role in modulating the effects of stressors on psychological well-being (Caspi et al., 2003; Canli and Lesch, 2007) and that 5-HTT long allele carriers tend to be more resilient, particularly in the face of adverse life experiences (Karg et al., 2011).

Importantly, in addition to the genotypic factor, the cultural factor represented by NALS contributed to MLS for more than 3 years after immigration. Thus, people’s culturally shared tendency to be satisfied with life may have developed independently from the prevalence of the long allele in cultural groups, and they seem to provide independent and equally important underpinnings for migrants’ satisfaction with the life in a new country. MLS was higher also among those from more individualistic, less hierarchical/mastery-oriented, and less tight cultures. Nevertheless, these cultural factors were no longer significant influences when NALS and long allele prevalence were controlled for.

Why are migrants with certain cultural and genotypic backgrounds, compared to others, able to enhance their life satisfaction more in their destination country? It may be that individuals with a long allele of 5-HTT tend to be better at coping with stress than those with short alleles as argued by others in the literature (Canli and Lesch, 2007). Furthermore, this may be also due to cultural groups with greater prevalence of long allele tend to have greater knowledge that is useful for coping with daily hustles, such as utilizing social support and engaging in stress-release activities (Sherman et al., 2009). Upon arrival in the new country, these migrants may actively seek new social ties and gather resources that enhance their adaptation to the new environment. These new resources would assist them further in settling firmly into the host society, and thereby increasing their life satisfaction.

Furthermore, culture and genotypic factors may influence the ways in which people construct their everyday experiences. For instance, Oishi (2002) and Oishi and Diener (2003) found cultural differences in how people evaluate neutral life events such as ball throw. Although the immediate evaluation of the experience was similar between the European American and Asian American groups, the experience was rated more positively by European than Asian Americans 1 week later. Such differences in personal constructions of events may be associated with genotypes and further accentuated by culturally available behavioral and communicative scripts (Uchida and Kitayama, 2009; Miyamoto et al., 2010). Future research will test these ideas.

This investigation has some limitations. Because of the lack of genotypic data, a relatively small number of cultural groups were analyzed. Especially, only one group from each of Africa and South America was included in our analysis, which may have weakened our results because the long allele is highly prevalent in these populations (we thank an anonymous reviewer for suggesting this). Our research needs to be replicated when more genotypic data become available from those areas. It should be noted also that it was not possible to include individual migrant’s genotypic data in our analyses because the data we analyzed had been collected in the 90s. Future studies should investigate the effects of individual migrants’ genotypes and stress level on their well-being.

It is furthermore possible that the present results are due to the cultural distance or general cultural similarity between country of origin and Australia, rather than 5-HTT long allele prevalence or NALS in the migrants’ home countries. Relevant to this issue, one of the current authors has recently examined the relationship between cultural distance and psychological well-being (GHQ) among migrants from 49 countries to Australia, by using indices of cultural distance based on multiple value dimensions (e.g. Hofstede’s four dimension, Hofstede, 2001). Limited evidence for cultural distance—well-being relation was found (Kashima and Abu-Rayya, in press). Future research should examine how immigrants’ life satisfaction is influenced by the similarity in gene-culture configuration between countries of origin and destination.

Finally, although we have focused on the role of 5-HTT genotype in life satisfaction there are undoubtedly many other gene variants that may also influence this measure. For example, several gene variants in

![Fig. 1 MLS as a function of L% and time. All other predictor variables were set at 0 (i.e. mean for centered variables, and 0 for non-centered ones).](image-url)
diverse neurotransmitter systems, as well as mineralocorticoid and glucocorticoid receptors, have been linked to changes in stress reactivity and stress-related disorders (De Rijk, 2009), and hence may influence life satisfaction. Future research should examine the potential links between these gene variants and life satisfaction within a gene-culture coevolutionary framework.

SUPPLEMENTARY DATA
Supplementary data are available at SCAN online.

REFERENCES


