How Universal Is the General Factor of Personality? An Analysis of the Big Five in Forager Farmers of the Bolivian Amazon

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Abstract

In various personality models, such as the Big Five, a consistent higher order general factor of personality (GFP) can be identified. One view in the literature is that the GFP reflects general social effectiveness. Most GFP studies, however, have been conducted in Western, educated, industrialized, and rich democracies (WEIRD). Therefore, to address the question of the universality of the GFP, we test whether the GFP can also be identified in a preliterate indigenous sample of Tsimane by using self-reports, spouse reports, and interviewer ratings. In the Tsimane, a viable GFP could be identified and the intercorrelations between personality traits were significantly stronger than in samples from industrial countries. The GFP correlated with the ratings of social engagement. In addition, self and spouse ratings of the GFP overlapped. Overall, the findings are in line with the notion that the GFP is a human universal and a substantive personality factor reflecting social effectiveness.

Keywords

general factor of personality, Big Five, indigenous, Tsimane, social effectiveness, cross-cultural comparisons

Introduction

The Big Five (Goldberg, 1981) or the closely related five-factor model (McCrae & Costa, 1997) currently is among the most widely used and acknowledged model of personality, consisting of openness to new experience/intellect, conscientiousness, extraversion, agreeableness/altruism,

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and neuroticism (O, C, E, A, N, respectively). Several previous studies have replicated and validated the Big Five in a range of settings and countries (e.g., see McCrae & Allik, 2002). One major assumption is that the Big Five dimensions represent the highest meaningful personality factors and that they are conceptually independent from each other. Another assumption is that the Big Five reflect a universal structure characterized by " . . . uniform covariance among traits in humans despite vastly different culture, history, economy, social life, ideology, and every other form of cultural and behavioral expression" (Gurven, von Rueden, Massenkoff, Kaplan, & Lero Vie, 2013, p. 354).

In recent research, however, both assumptions have been challenged. First, it has now been clearly shown that across samples and methods, the Big Five are not statistically independent, but show consistent and relevant intercorrelations (Figueredo, Vásquez, Brumbach, & Schneider, 2004; Musek, 2007; Rushton, Bons, & Hur, 2008; Van der Linden, Te Nijenhuis, & Bakker, 2010). These Big Five intercorrelations lead to a substantial proportion of shared variance labeled as the general factor of personality (GFP). The GFP has been described as a higher order personality factor capturing most of the socially desirable ends of personality scales (Figueredo et al., 2004; Musek, 2007; Rushton et al., 2008) and can be found not only in the Big Five but also in every other personality model. In terms of the Big Five, individuals high on the GFP are assumed to be relatively open minded, diligent, sociable, friendly, and emotionally stable. The notion that a general factor exists in personality measures has led to a growing body of research exploring the properties of the GFP. Some scholars have suggested that the GFP is a substantive factor at the apex of the hierarchical structure of personality (Dunkel & Van der Linden, 2014; Figueredo et al., 2004; Van der Linden, Dunkel, & Petrides, 2016). As such, it may play an important role in understanding individual differences. The currently leading substantive interpretation of the GFP is that it represents a general "social effectiveness," reflecting knowledge about what is socially desirable behavior, the motivation to behave in socially desirable ways, and the ability to do so (Dunkel & Van der Linden, 2014; Loehlin, 2012; Rushton & Irwing, 2011). Note that such a tendency should not be considered mere impression management or "faking" but instead would represent a relevant aspect of one's character as it is consistent over time and context (Van der Linden et al., 2016).

The social effectiveness interpretation is supported by meta-analytic findings (Van der Linden et al., 2017) showing that the GFP is strongly associated—in the range from $r = .70$ to $.85$—with trait measures of emotional intelligence as well as with scores on ability tests of emotional intelligence ($r \approx .30$). In addition, the GFP is associated with a range of other social effectiveness outcomes such as peer-rated social status (Van der Linden, Scholte, Cillessen, & Nijenhuis Te Segers, 2010).

Alternative interpretations of the GFP assume that it mainly represents a methodological or statistical artifact. For example, it has been suggested that the GFP merely arises due to the tendency to provide socially desirable answers on personality questionnaires rather than reflecting genuine behavioral tendencies (e.g., Revelle & Wilt, 2013). These alternative interpretations of the GFP are based on the findings that the general factor becomes less prominent when reframing personality items in such a way that they no longer have a clear socially desirable component (Bäckström, Björklund, & Larsson, 2009). Other studies have emphasized the possibility of statistical artifacts (Revelle & Wilt, 2013) or familiarity biases (Gnambs, 2013) leading to the GFP.

The debate about the substantive interpretation of the GFP versus its different (statistical and methodological) artifact interpretations spans across a wide range of arguments and studies, has been discussed extensively in several previous articles (e.g., Revelle & Wilt, 2013; Van der Linden et al., 2016; Van der Linden et al., 2017), and would go beyond the scope of the present study. Although the debate is ongoing, there seems to be a growing number of studies indicating that the GFP has a relevant substantive component. For example, the artifact interpretation of the GFP is at odds with the findings that the GFP is meaningfully related to a wide range of other,

non–self-report outcomes such as other-rated and objective job performance (Sitser, Van der Linden, & Born, 2013; Van der Linden, Te Nijenhuis et al., 2010), participant's choices in a social dilemma game (Dunkel, Summerville et al., 2014), and objective indicators of delinquent behavior (Van der Linden, Dunkel, Beaver, & Louwen, 2015).

All in all, existing evidence supports the notion that, even though the general factor may reflect some level of artifactual variance, the GFP mainly represents a substantive factor causing correlations between personality traits and, thereby, challenging the assumption of independence of the Big Five (Dunkel, van der Linden, Brown, & Mathes, 2016).

Regarding the second assumption we referred to, namely, the human universality of the Big Five, there is a range of studies indeed confirming the five factors in various, mainly Anglo European countries and cultures (McCrae & Allik, 2002). Yet, different numbers of basic personality factors have been reported in some cultures (Lee & Ashton, 2004). For example, more than five personality factors could be identified in non-Western cultures (Cheung & Leung, 1998). In addition, De Raad et al. (2010) concluded that, based on the lexical approach, only three stable personality factors could be replicated across cultures. They also reported that, in their cross-cultural data set, " . . . there seems to be a robust emergence of a single factor" (De Raad et al., 2010, p. 169). Although, they stated that this single factor was mainly based on agreeableness, conscientiousness, and honesty/humility, the average (across the 14 taxonomies) trait intercorrelation matrix they reported suggests that the single factor has similarities with the GFP. For example, based on the matrix reported in De Raad et al. (2010), we extracted the first unrotated factor (using principal axis factoring), which lead to a general factor that explained 24.35% of the shared variance (36.08 of the total variance) and loadings of .52, .34, .29, .57, .55, and .42, for honesty/humility, stability, extraversion, agreeableness, conscientiousness, and openness/intellect, respectively. The amount of variance explained by the first factor and the factor loadings are similar in magnitude to those of previous studies on the GFP (Figueredo et al., 2004; Musek, 2007; Rushton & Irwing, 2011; Van der Linden, Te Nijenhuis et al., 2010).

Finally, studies from a large research project that aims to measure personality in the various ethnic groups in South Africa (The South Africa Personality Inventory [SAPI]; e.g., Cheung, van de Vijver, & Leong, 2011; Nel et al., 2012) found that those measures contain a large shared social desirability component reflecting so-called genuine "social-relational functioning." This conceptualization seems to overlap with the existence of the GFP as a general social effectiveness factor. Thus, the results from De Raad et al. (2010) and the SAPI project (e.g., Nel et al., 2012) indicate that the GFP may possibly be one of the most consistent factors in personality across cultures.

In line with this idea, a logical next step that can contribute to insight into the universality of the GFP is to further test whether the GFP can also be identified in largely preliterate, indigenous societies. Therefore, in the present study, we do so by building on a previous study of Gurven et al. (2013), who tested the Big Five in a largely preliterate society, namely, the Tsimane, living in the Bolivian Amazon. Gurven et al. noted that most of the Big Five studies have been conducted in urban and literate populations; yet, populations such as the Tsimane are interesting because such societies are better representations of the way humans lived for much of their evolutionary history than Western, educated, industrialized, and rich democracies (WEIRD) populations (sensu Henrich, Heine & Norenzayan, 2010).

Gurven et al. (2013) assessed personality by means of a bilingual native interviewer. For validation purposes, they also used interviewer ratings of the participants' social engagement and spouse ratings of personality. Even after applying various statistical models and controlling for several possible artifacts, they found that the five-factor structure of personality did not sufficiently emerge from the exploratory and confirmatory factor analyses (CFAs). One of the reasons for this may have been the relatively strong intercorrelations between the Big Five, which seems to suggest the presence of a general factor. Given these findings, a relevant and pertinent test is

whether the GFP can be found in the Tsimane population. This question was not addressed in the original study of Gurven et al. (2013). Nevertheless, scholars who adopt the substantive interpretation of the GFP have argued that this construct may have evolved due to evolutionary selective pressure toward altruistic and socially effective behavior (e.g., Figueredo et al., 2004; Rushton & Irwing, 2011). Thus, similar to the initial theorizing on the Big Five, the GFP is assumed to reflect a universal personality factor that has evolved in a historical context of frequent social interactions between individuals (e.g., kin).

In the present study, we reanalyze the findings from Gurven et al. (2013) and test (a) whether a viable GFP can be identified in a large sample of Tsimane participants; (b) whether the characteristics of the GFP (e.g., factor loadings) are similar to those found in mainly Western, urban, and literate samples; (c) whether such a GFP relates to specific social behaviors (e.g., smiling, shyness) during the interview, as rated by a native interviewer: and (iv) whether a GFP based on self-reports converges with a GFP based on spouse ratings. Such tests may provide an important piece of information in the debate about the nature of the GFP and would provide further insight into the universality of this construct.

The GFP in the Tsimane

Regarding the existence and magnitude of the GFP in contemporary preindustrial populations, two contrary theoretically derived hypotheses can be formulated. One is that there is a weak to nonexistent GFP in such societies, consistent with the notion that the GFP has been shaped by relatively *recent* directional selection (Figueredo & Rushton, 2009). In the literature, there is some debate about whether directional selection (e.g., on personality, intelligence) can be responsible for individual difference on traits (for a review, see Buss & Hawley, 2010). For example, one assumption is that any trait that would pose a positive effect on general fitness would eventually become universal. Nevertheless, it had been argued and shown that various processes such as mutation load or exposure to different environments can be reconciled with the notion of natural selection on traits and individual differences (Penke, Denissen, & Miller, 2007). Using genetic analyses on the number of runs of homozygosity that reflect the levels of inbreeding, Verweij et al. (2012) found support for the notion that the shared variance of personality traits (i.e., the GFP) has been subjected to directional selection (the higher the better) yet, still shows substantial individual differences.

As the Tsimane live under less socially and technologically complex conditions than contemporary agricultural or industrial populations, they may have been exposed less strongly to the evolutionarily novel social demands that could have driven the evolution of the GFP (e.g., selection for higher levels of cooperative prosociality with nonkin and strangers, tighter social cohesiveness for group competition; Figueredo et al., 2004; Figueredo, Woodley, Brown, & Ross, 2013). In that case, the positive manifold of correlations among the Big Five in the Tsimane would be lower compared with that found in populations living in industrialized countries.

The second, and contrary, theoretically derived hypothesis starts with the assumption that the GFP is an indicator of a so-called life history strategy (Dunkel, Kim, & Papini, 2012; Figueredo, De Baca et al., 2013). Life history (LH) theory is a midlevel evolutionary theory that posits that species can be placed on a continuum from fast to slow reproductive strategies (Wilson, 1975). A fast LH strategy implies that there is relatively much investment in mating and producing offspring, and lower investment in parental care. A slow LH strategy is indicated by the opposite pattern, meaning lower investment in mating and producing offspring and higher levels of parental care.

Although originally developed to explain differences in reproductive strategies between species, it has been shown that individual and group differences in life history also exist within the human species (Figueredo et al., 2004; Woodley, 2011). Different LH strategies are assumed to have evolved due to varying environmental demands. Particularly, harsh and unpredictable demands would have favored a faster life history strategy because, in such an environment, there

would be relatively high infant mortality, which reduces the evolutionary advantages of high parental investment (Brumbach et al., 2009). Furthermore, LH strategy has been aligned with a range of other individual differences, including personality (Figueredo, De Baca et al., 2004).

The theoretical background of the second of the alternative hypotheses is the so-called *strategic differentiation–integration effort* (SD-IE) theory that posits that the more one tends toward a slower LH strategy, the greater the degree of strategic differentiation among the components of life history, and vice versa in the case of those with a fast life history, who become more strategically integrated (Figueredo, Woodley et al., 2013; Woodley, 2011). This implies that the various indicators of LH strategy, among which are personality dimensions, would be less strongly correlated among individuals adopting a slower LH strategy. Specifically, the relatively predictable environment that may have led to a slower LH strategy is assumed to allow more division of labor and specialization among individuals (e.g., a more differentiated pattern of personality traits). However, in harsh environments yielding faster LH strategies, specific traits would be more tightly coupled to better deal with the diverse and unpredictable dangers (such as disease outbreaks, famine; Foster et al., 2005).

Following the line of reasoning above, it can be inferred that *if* specific personality measures (e.g., the Big Five, facets, or even items) partly indicate the GFP and *if* the GFP is an indicator of LH strategy, *then* SD-IE would predict that the intercorrelations among personality measures would be lower when moving toward a slower LH strategy and show higher intercorrelations toward a faster LH strategy. Precisely, this has been observed (see Figueredo, Woodley et al., 2013; Woodley, 2011, for an overview of these findings).

Regarding the Tsimane, there are studies suggesting that they live in, and are presumably adapted to, an environment that would favor a faster LH strategy. For example, total fertility rates (TFRs) and infant mortality are both well-known LH indicators and are known to be relatively high among the Tsimane (TFR = 9; infant mortality = 13%; Gurven, 2012). In addition, it has been shown that the Tsimane have more exposure to health threats as, for instance, reflected by higher levels of infectious diseases and inflammatory immune responses (Gurven, Kaplan, & Zelada, 2007) and greater growth stunting (Foster et al., 2005; Nyberg et al., 2012). Consistent with this pattern, roughly half of both infant and adult deaths are due to infections (Gurven et al., 2007).

Thus, insofar as the Tsimane may indeed have adopted a faster LH strategy, it can be expected, based on SD-IE, that they would show a *stronger* GFP as reflected by *higher* intercorrelations among lower level indicators, *stronger* factor loadings on the GFP, and a *larger* proportion of explained variance in those lower order indicators due to the GFP. Therefore, comparing GFP-indicator factors loadings in the Tsimane with those found in Western samples would help us decide which of the two opposing hypotheses described above is more likely given the empirical data.

Method

Ethics Statement

The study and consent procedures were approved by the Institutional Review Board (IRB) of the University of California, Santa Barbara. In Bolivia, all procedures were approved by the Tsimane Government (Gran Consejo Tsimane), by village leaders, and by study participants. Because many Tsimane do not read or write, participant permission was verbal and it was obtained twice: an initial affirmation to participate and a second confirmation once all procedures had been explained.

Sample and Procedure

Gurven et al. (2013) conducted their research among the Tsimane, forager horticulturalists living in the central lowlands of Beni, Bolivia. The Tsimane live in more than 85 villages that range

from 30 to 500 individuals. Before the mid-20th century, they had sporadic contact with market influences, although that has increased since the 1970s when roads and other infrastructure connected the region to the highlands. Although the Tsimane have had increasing access to public schooling, the adult literacy level is still low at 25%. A more detailed ethnographic description of the Tsimane culture and lifeways can be found in Gurven et al. (2007; Gurven et al., 2013).

Self-reported personality was assessed among $N = 632$ Tsimane (48% female, average age = 47 years, range = 20-88 years) using translated Big Five items that were administered via interview by a bilingual, trained Tsimane assistant (see "Measures" section). In addition, by using a similar (interview) procedure, Big Five spouse ratings were obtained of $N = 430$ Tsimane. As described in Gurven et al. (2013), due to the fact that the self and spouse ratings were often collected in different communities, the two types of ratings overlapped (i.e., the other rating could be linked to self-rating) for a relatively small sample, $N = 68$. The reason for this was that the personality interviewer traveled with a medical team and had to follow their schedule of village visits. Nevertheless, this smaller subsample still allowed cross-validation tests of the level of rater agreement on the GFP in a similar way that Gurven et al. (2013) used the sample to compare self–spouse agreement on the Big Five.

Measures

The Big Five. The Big Five were measured with the 44-item Big Five Inventory (BFI; Benet-Martínez & John, 1998). A careful and elaborate procedure was adopted to translate the items into the Tsimane language. A previously validated Spanish version of the BFI was translated into Tsimane language. Then, the accuracy of the translation was tested by back translation by a different translator. Due to some fundamental differences between the Tsimane language and Spanish, there were some difficulties with a number of items. For instance, limitations of the Tsimane vocabulary did not allow a direct translation of some items. Consequently, those items had to be translated into a form that best suited the original aim of the item. For example, the item "is clever and analytical" was translated into Tsimane language into something equivalent to "knows how to see things and can make things turn good" (for more examples, see Gurven et al., 2013). One item of the BFI, namely, "has an active imagination" could not be adequately translated into Tsimane langue. Subsequently, Gurven et al. (2013) decided to delete that item resulting in a final BFI version including 43 items.

The final set of items had a 5-point Likert-type answering format (1 = *strongly disagree*, 5 = *strongly agree*) and were administered in a private location by a native interviewer trained in anthropological and psychological research. Participants were given a quick explanation of the use of the answering scale and received a small test on their understanding of it. Due to the fact that the group of researchers had already spent about a decade visiting the same Tsimane communities, few study participants were new to formal interviews such as those reported here.

In their original study, Gurven et al. used different methods to test the reliability of the Big Five factors. For example, they reported the reliabilities of the scales based on the full set of 43 items, the scales after removal of the least internally consistent item, scales without reverse-scored items, and the scales after removal of high (>4) or low (<2) mean responses. In addition, they provided the Big Five reliabilities after controlling for acquiescence bias. In the present study, we used the most conservative estimates of the Big Five reliabilities (Cronbach's αs), which, for the self-report measures were .63, .58. .69, .54, and .31, for O, C, E, A, and N, respectively (see Table 1 in Gurven et al., 2013). For the spouse ratings, these reliabilities were .47, .39, .44, .43, and .07 for O, C, E, A, and N, respectively.

Interviewer ratings of observed social behavior. For validation purposes, after the personality assessment, the interviewer used 5-point Likert-type scales to score the participants on four aspects of

Table 1. Fit Statistics of the CFA/SEM Models.

	N	χ^2	df	p	TLI	CFI	RMSEA
Basic CFA models							
Direct GFP	632	19.61	5	<.001	.97	.99	.07
Hierarchical GFP	632	a	a	a	a	a	a
Hierarchical GFP (loadings equal, no error variance)[b]	632	27.23	7	<.001	.96	.98	.07
SEM models							
GFP interviewer/ratings	632	124.88	25	<.001	.90	.92	.08
Spouse ratings included	68	96.15	73	.04	.92	.95	.07

Note. CFA = confirmatory factor analysis; SEM = structural equation modeling; TLI = Tucker–Lewis index; CFI = comparative fit index; RMSEA = root mean square error of approximation; GFP = general factor of personality.
[a]This model did not converge due to several Heywood cases indicating that stability and plasticity are not viable constructs in the Tsimane sample.
[b]Setting the loadings on plasticity/stability to one and allowing no error variance means testing that stability and plasticity are in fact redundant to each other and to the GFP.

their social interaction during the personality interview and another unrelated interview (which lasted approximately 30 min), namely, (a) talkativeness, (b) shyness, (c) distractedness, and (d) level of smiling and/or making jokes. These ratings were added to the design to gauge validity of the personality measurement. Before the actual interviews, several test runs were performed to ensure consistency in the interviewer ratings of the participants.

Statistical Analysis

In the majority of published studies on the GFP, the general factor is operationalized as the shared variance directly extracted from the personality trait level (e.g., Musek, 2007; Rushton & Irwing, 2011; Van der Linden et al., 2017). To be compatible with the previous literature, we adopted a similar approach. One potential limitation to this method is that Gurven et al. (2013) reported that the Big Five showed relatively low reliabilities in the Tsimane. Moreover, as the universality of the Big Five has been debated, one question that may arise is whether it would be methodologically sound to extract a GFP from the Big Five in this sample. However, several previous studies have also clearly confirmed that the extraction of the GFP is robust to type of extraction method (i.e., factor analytic technique), measurement level (e.g., items, facets, traits), and even personality model (Big Five, Big Six, Giant Three, etc.; for a review, see Van der Linden et al., 2016; Van der Linden et al., 2017). Thus, any type of measurement that assesses a relatively broad (but not necessarily comprehensive) array of personality traits may yield a general factor that is a rather good reflection of the GFP. This has been argued and shown in various previous studies (Rushton & Irwing, 2011). As such, it can also be assumed that extracting the GFP from the broad range of traits assessed in the Tsimane may yield a viable GFP.

Nevertheless, as an additional validation of this principle, we checked whether the GFP extracted from the trait level is similar to the one extracted directly from the items. When the overlap is indeed as high as expected (correlations > .95), we proceed with the GFP based on trait level, as in line with the previous literature.

We used CFA and structural equation modeling (SEM) to test the viability of the GFP in the Tsimane sample, and to examine its relation with interviewer and spouse ratings. As described above, the N varied in the different analyses. Therefore, for each analysis, we explicitly provide information about the N. In line with the meta-analysis of Van der Linden, Te Nijenhuis, and Bakker (2010), in the CFA, we compare a model in which the GFP directly loads on the Big Five

with an alternative hierarchical model. In the latter model, we pose two intermediate higher order factors above the Big Five, namely, stability and plasticity. These two higher order factors have been mentioned in a range of previous studies (e.g., De Young, 2006). Stability has been described as a broad socialization factor and consists of a mix of conscientiousness, agreeableness, and low neuroticism (or high emotional stability). Plasticity is presumed to reflect a general tendency to seek new and rewarding experiences (De Young, 2006) and it consists of a mix of extraversion and openness to new experiences.

Among the two models described above, the one that is theoretically valid and shows the best fit is subsequently used in SEM in which we test the validity (interviewer ratings) and the relations with the spouse ratings of personality. With regard to the latter, the main questions were whether the GFP based on self-reports were related to the spouse-rated GFP and whether the spouse-rated GFP shows similar relations to the interviewer ratings of social behavior.

To compare the characteristics of the GFP in the Tsimane with those found in mainly Western samples, we used the BFI data from a previous large meta-analysis on the GFP (Van der Linden, Te Nijenhuis, et al., 2010). Those data were based on $k = 24$ studies and comprised a total of 54,638 participants. The total sample consisted of 58.5% adults from the populations of various industrialized countries, 37% university students, and 4.2% special groups such as medical patients. We compare the Western and Tsimane samples on the Big Five intercorrelations, the level of variance explained by the GFP, and the Big Five factor loadings. Factor loadings are analyzed by using multiple group CFA in which a model that assumes equal factor loadings in the Tsimane and Western samples is compared with a model in which the factor loadings are freely estimated.

Results

GFP Tests

As expected, the GFP extracted directly from the trait level (Big Five) correlated highly with a GFP directly extracted from the items ($r = .97$). In fact, the correlation was so high that they can be considered virtually identical. Subsequently, to stay consistent with most of the previous literature on this topic, we continued further analyses with the GFP from the trait level.

The CFA model in which the GFP directly loaded on the underlying traits fits well according to the general guidelines of fit indices (Hu & Bentler, 1998). As the chi-square was significant, this indicates that the model did not fit perfectly. Possible reasons for this is that (a) besides the presence of a general factor, there may be a few other direct relations between the specific traits that were not modeled and are not central to the present theoretical framework; and (b) due to the relatively large N, even small deviations from the model may become significant. The fit statistics of this model are provided in Table 1 under the label "Direct GFP." The alternative hierarchical model (see "Statistical Analysis" section) initially failed to converge due to several Heywood cases. Specifically, there were negative error variances. Heywood cases are informative, in the sense that, they indicate that the model is not in line with the data. In this case, they indicated that a model that assumes stability and plasticity as two separate intermediate-level factors is not viable due to a too large overlap between the two factors. The only way the model did converge (see Table 1 for fit indices) was by setting the GFP loadings on the two intermediate factors to one, and not allowing any error variance of stability and plasticity. Those adjustments basically confirm the overlap of the two intermediate factors.

To calculate the reliability of the GFP in the best fitting model, we used the Mosier (1943) composite reliability formula, which is based on the variance of the underlying components (in this case the Big Five), their intercorrelations, their loadings of the higher order factor, and their
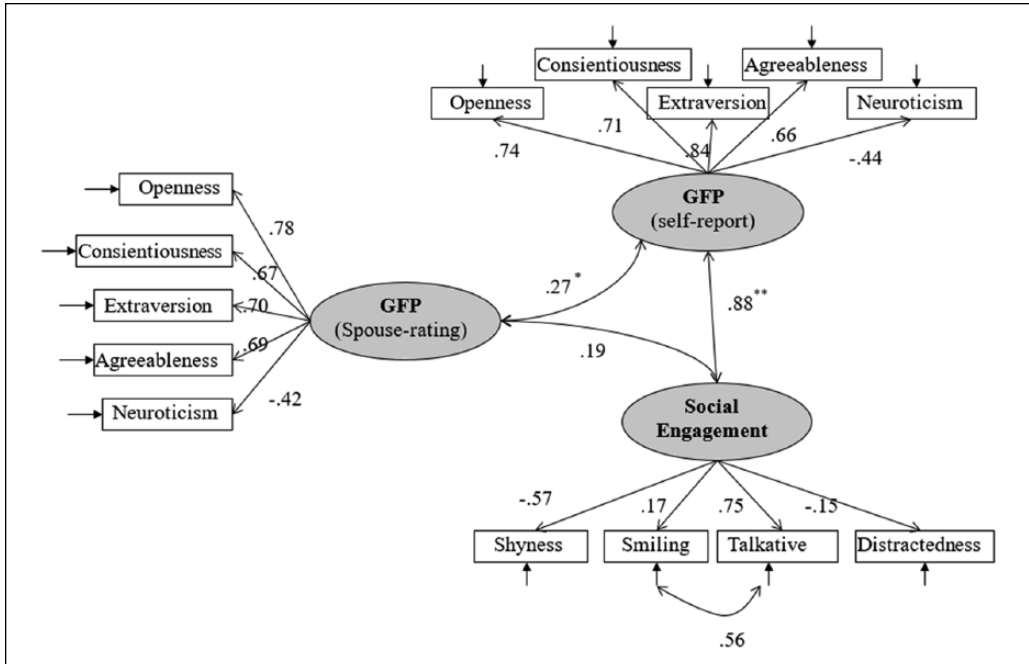
Figure 1. Final model summarizing the findings on self-reports, interviewer ratings, and spouse ratings.
Note. GFP = general factor of personality.

reliabilities (see "The Big Five" section above). The Moser composite reliability estimate of the GFP was .82, showing that the GFP is a reliable personality construct in this sample.

GFP Validity Tests

To further test its validity, the direct GFP was expanded by allowing the GFP to correlate with a latent factor representing the common variance of the four interviewer-rating scores. The latent interviewer-rating factor appeared to reflect general social engagement. Specifically, it was characterized by being talkative and smiling, and by low scores on shyness and distractedness with loadings of .75, .17, −.57, and −.15, respectively. Subsequently, this factor was labeled *social engagement*. The initial model in which the interviewer-rating factor was correlated to the GFP showed a moderate to poor fit, $\chi^2 = 316.01$, $df = 26$, Tucker–Lewis index (TLI) = .85, comparative fit index (CFI) = .89, root mean square error of approximation (RMSEA) = .12. Yet, allowing the unique variance of being talkative and smiling to correlate led to a strong increase in model fit (see Table 1). Note that allowing one pathway between error variance increases the model fit but it does not affect the basic relationships between the constructs in the model. In the model, the social engagement factor correlated no less than $r = .88$ with the GFP based on self-reports.

In a subsequent analysis, we further expanded the model by adding the spouse ratings, which were obtained for a subsample of 68 participants. In this model, the spouse ratings of the Big Five were assumed to have direct GFP loadings (similar to the basic GFP model described above). The spouse-based GFP was allowed to correlate with the self-report–based GFP and the interviewer-rated social engagement factor. As can be seen in Figure 1, each of the spouse-rated Big Five dimensions showed strong GFP loadings in the expected direction. The resulting model showed a good fit to the data. More important, however, was that the GFP extracted from the spouse

Table 2. Big Five Inventory-Based Big Five Intercorrelations and GFP Factor Loadings in Western and Tsimane Samples.

	Big Five intercorrelations	
	Western samples (N = 54,638)	Tsimane (N = 639)
OC	.15	.55
OE	.30	.60
OA	.12	.55
ON	−.10	−.30
CE	.18	.60
CA	.29	.59
CN	−.18	−.44
EA	.13	.53
EN	−.23	−.41
AN	−.24	−.29
	GFP loadings on the Big Five	
O	.38	.74
C	.47	.71
E	.47	.84
A	.45	.66
N	−.43	−.44

Note. GFP = general factor of personality; O = openness to new experience/intellect; N = neuroticism; C = conscientiousness; E = extraversion; A = agreeableness/altruism.

ratings showed a significant correlation of $r(68) = .27$ ($p = .03$) with the GFP based on self-report. Note that this level of overlap was relatively strong compared with the overlap between self- and spouse-rated Big Five dimensions, which were $r(68) = .27, −.13, .24, .25,$ and $.19$ for O, C, E, A, and N, respectively (see Gurven et al., 2013). The spouse-based GFP correlated, $r(68) = .19$, with the interviewer-rating factor of social behavior. Although, this correlation was in the expected direction it did not reach significance.

Comparing the GFP in the Tsimane and Western Samples

Table 2 shows the BFI-based Big Five intercorrelations for both the Tsimane sample and the Western samples. For each pair of personality factors, the intercorrelations are substantially higher in the Tsimane sample. Given the large sample sizes, each of these differences were highly significant (calculated by using r-to-Z transformations). In addition, Table 2 shows that, compared with Western populations, the Tsimane exhibit substantially higher Big Five loadings of the GFP. The GFP also explained more variance in the Tsimane (49.3%) compared with the WEIRD samples (19.7%).

A multiple group CFA model in which the GFP loaded directly on the Big Five and that assumed that the factor loadings were equal in both groups had 14 *df*s and a $\chi^2 = 3,363.07$. A similar model in which the factor loadings were unconstrained, had 10 *df*s and a $\chi^2 = 3,315.25$. The chi-square difference test showed that the model with unconstrained pathways, implying unequal factor loadings in the groups, was significantly better than the model that assumed equal factor loadings ($\Delta\chi^2 = 47.82$, $\Delta df = 4$, $p < .0001$). Thus, this confirmed that the Big Five factor loadings were significantly and substantially higher in the Tsimane sample compared

with the Western samples. These results are inconsistent with the first prediction described in the "Introduction" section, which posited that the Tsimane exhibit a weaker GFP. Instead, these results show that among the Tsimane, the GFP is actually stronger (as indicated by stronger intercorrelations of lower order personality factors) and explains more variance in the underlying (Big Five) traits.

In comparing the Tsimane and Western samples, we tested the factor structure defined by the trait/item intercorrelations but did not directly test mean scores on the GFP. The reasons for that approach are twofold. First, although comparing mean scores on personality scales in various groups has been described in several previous studies, it has also become apparent this method is problematic when applied in cross-cultural settings (Heine, Buchtel, & Norenzayan, 2008; Van de Vijver & Leung, 2001). For example, due to various limitations such as the reference-group norm (i.e., to whom does one compare when filling out the questionnaires), comparing mean scores on personality scales often leads to nonsensible outcomes and conclusions (Heine et al., 2008), whereas comparing factor structures may be a more valid method of cross-cultural comparisons because it relates to the factor structure of personality rather than the mean scoring level (Lukaszewski, Gurven, von Rueden, & Schmitt, 2017).

Discussion

In the present study, we examined the GFP in a largely preliterate, indigenous sample of forager horticulturalists. In this sample, a general factor could clearly be identified in the personality measures. Extracting the GFP either directly from the items or from the Big Five did not make a difference as the two operationalizations of the general factor were virtually identical. Applying the Mosier reliability test for composite scores showed that the GFP is a rather reliable construct in the Tsimane sample, with a coefficient of .82. Such a finding is in accordance with the "aggregation principle" stating that higher order constructs tend to be more stable and reliable because they have less error variance than lower order measures such as items or scale scores.

The total pattern of findings further indicates that the GFP in the Tsimane has similar characteristics as in WEIRD samples (Figueredo et al., 2004; Musek, 2007; Van der Linden et al., 2016; Van der Linden et al., 2017). That is, the GFP in the Tsimane sample reflects a mix of socially desirable traits, indicating a general *social effectiveness* (e.g., Dunkel & Van der Linden, 2014; Loehlin, 2012; Van der Linden et al., 2016). The latter was also supported by the strong correlation between the GFP and the ratings of social engagement. Specifically, during the interview, high-GFP Tsimane were generally more talkative and engaging, less shy and distracted, and they smiled more. Although it is true that these social behaviors may have different meanings in different cultures, they were regarded by the researchers of the Tsimane project as typical for individuals who are more affable, confident, and socially involved. In this light, it is imperative to note that the individual who actually conducted the interviews was a Tsimane, trained in doing anthropological research.

The spouse-rated GFP was significantly correlated with the GFP based on self-reports, thus suggesting consistency among different raters. In an absolute sense, the interrater correlation was not high ($r = .27$). However, this value should be evaluated in light of the interrater overlap on the Big Five, which in this sample ranged from $r = -.13$ (for C) to a maximum of $r = .27$ (for O), with an average of .17.

One notable finding was that, compared with Western samples, the GFP was rather strong in the Tsimane sample. The Big Five intercorrelations were higher, leading to high GFP factor loadings. In fact, it may have been quite likely that previously mentioned (Gurven et al., 2013) difficulties in extracting clearly distinguishable Big Five dimensions in the Tsimane population may have been due to these higher intercorrelations among the items/traits. Compared with the

Western samples, the GFP in the Tsimane also explained a higher percentage of variance in the underlying personality dimensions.

The results regarding the comparison with WEIRD samples are in line with the notion of the SD-IE (Dunkel, De Baca, Woodley, & Fernandes, 2014; Figueredo, Woodley et al., 2013; Woodley, 2011) and seem to suggest that, in modern (often) Western societies, more specialization has occurred with respect to personality patterns. In other words, specific lower order personality dimensions seem to be coupled more loosely in modern societies (see also Lukaszewski et al., 2017). This idea may guide future research on SD-IE among different populations, living under circumstances that favor slower versus faster life history strategies (Woodley, 2011). In line with reasoning in the SD-IE, the finding of a stronger intertwining of personality dimensions (e.g., items, Big Five) also seems to suggest lower mean GFP scores. Nevertheless, as we argued that direct comparisons on mean scores would be problematic and could not be made with regard to the meta-analytic data, this topic remains open and should be addressed in future studies that used identical instruments and procedures in Tsimane and other (e.g., Western) samples.

As the evidence outlined above favors the interpretation of the GFP in the Tsimane, this leads to the interesting possibility that the GFP is a cross-culturally consistent factor that may be even more robust than the Big Five or other specific trait models (e.g., the six-factor model; Lee & Aston, 2004). This idea fits with previous studies that have indicated that a general factor of genuinely social desirable behavior (similar to the GFP) robustly emerges from most cross-cultural personality data sets (e.g., Cheung et al., 2011; De Raad et al., 2010; Nel et al., 2012).

A universal GFP is also in accordance with several theories about the origin of the factor (Figueredo et al., 2004; Rushton & Irwing, 2011; Van der Linden et al., 2016). Specifically, as humans are social by nature, it has been proposed that general mechanisms, or "suites of traits," have evolved to deal with social demands and help to obtain social goals. For example, the theory of runaway social selection (Nesse, 2007) describes how population preferences for specific personality traits, through sexual selection, tend to lead to correlations between those traits. Thus, if traits such as generosity, reliability, sociability, and stability are considered as socially desirable by others, then it is likely that they eventually start to cluster. Note that insofar as there were indeed evolutionary processes selected for general social effectiveness, this does not exclude the maintenance of individual differences in the GFP. Several mechanisms such as balancing selection due to environmental heterogeneity, calibration of personality to other aspects of the phenotype, and mutation balance can still operate to produce differences in general social effectiveness (Lukaszewski et al., 2017; Penke et al., 2007). Nevertheless, it may be a plausible option that due to runaway social selection, the distinction between the preferences for those traits and the traits themselves would diminish. If that is the case, the display of social desirable behavior cannot simply be considering faking (or response bias) but would reflect a useful adaption to social demands.

The idea that selective mechanisms have favored those traits that are characteristic of the GFP is supported by a study that found direct evidence that Tsimane males, who possess a socially desirable mix of traits (high openness, extraversion, and conscientiousness, and low neuroticism), indeed have higher fertility (Gurven, von Rueden, Stieglitz, Kaplan, & Eid Rodriguez, 2014). Those previous Big Five findings can easily be converted into a test of the relationship between the GFP and fertility, because the GFP is a linear weighted combination of the Big Five. We did so by calculating the GFP by taking the sum of the weighted scores of the Big Five. Therefore, as an initial exploratory check on the GFP–fertility link, we conducted such analyses controlling for age, years of education, level of Spanish fluency, and the region of residence (e.g., down river, forest, near town). By applying this procedure, we found that for male Tsimane, each standard deviation increase in the GFP was associated with an average of 0.88 more children born ($B = 0.020$, $SE = 0.006$, $t = 3.34$, $p < .01$). For females, there was no significant relationship between the GFP scores and number of offspring ($B = -0.001$, $SE = 0.006$, $t = -0.21$, $p = .83$). The

latter is also in line with Gurven et al.'s (2014) findings on the Big Five and fertility. We cannot provide definitive explanations for why the GFP–fertility link (or the Big Five–fertility link, for that matter) would be stronger for males than females. However, one possible explanation is that, compared with males, females more strongly favor those personality traits in their partners that may indicate success in social competition and access to resources. It has indeed been shown that the socially desirable traits associated with the GFP relate to social status and resources (Van der Linden et al., 2016; Van der Linden et al., 2017). Moreover, von Rueden, Gurven, and Kaplan (2008) found that Tsimane males with socially desirable traits obtained higher social status in terms of getting their way in the group, the respect they receive, and their community influence. They also found that Tsimane with socially desirable scores on many of the personality traits had better health as indicated by lower stress hormones and more optimal body mass (von Rueden et al., 2008). Finally, a study by Todosijević, Ljubinković & Arančić (2003) showed that although both sexes dislike negative personality traits, males are more likely to tolerate them in their potential mates, and at the same time, several socially desirable traits in mates are considered more important by females.

All this supports the notion that during human evolution, those possessing a mix of socially desirable traits, on average, had higher numbers of surviving progeny. Further testing this idea in nonindustrialized samples such as the Tsimane may be particularly useful because, in many industrialized countries, traditional reproduction patterns may have been distorted by modernity (e.g., health care systems, contraception, and higher costs of raising successful offspring), leading to relatively low fertility societies and fertility patterns that may deviate from the majority of human history and cultures. The Tsimane, however, live in " . . . natural fertility conditions, without deliberate fertility control" (Gurven, von Rueden, Stieglitz, Kaplan, & Eid Rodriguez, 2014, p. 18). Tests of the role of personality in populations living under such conditions are, therefore, highly informative and provide a significant contribution to GFP theory.

Limitations

In interpreting the present findings, we note several limitations. The fact that the Big Five in the Tsimane population showed relatively low reliabilities indicates that those personality measures contained relatively large sources of measurement error variance compared with other Big Five studies. However, for several reasons, this does not compromise the conclusions of the present study. First, the principle of aggregation implies that even sets of measures that contain relatively large sources of error variance can lead to reliable higher order factors. Second, previous studies have confirmed that a valid GFP can be extracted from any set of measures that assess a relatively broad range of personality.

Another limitation was that the interview rating of social engagement was conducted by the same person who also conducted the personality assessment interview, and, therefore, the GFP–social engagement association possibly contains a certain level of common method variance (e.g., scores may be influenced by the personality or preferences of the interviewer). However, the present findings on the GFP and social behavior are fully in line with several previous studies that have adopted multiple methods and raters. Those studies have confirmed that high-GFP individuals tend to display more socially involved and effective behavior. The same interviewer ratings of social behavior have also been used as a partial validation of personality measures in several previous studies (e.g., Gurven et al., 2013). Finally, at the time of the data collection, the interviewer was completely unaware of the GFP and any possible hypothesis in that direction. Thus, it is unlikely that interviewer's observations were biased toward a particular idea on the associations between behavior and the GFP.

The relatively small subsample of spouse ratings of personality was also a limitation. The reason for this smaller subsample was that the required traveling scheme of the research team did

not allow extensive number of spouses to be interviewed. Nevertheless, despite the increased likelihood of statistical Type II errors for this subsample, significant associations were found with the self-reports.

Concluding Remarks

Testing the replicability of personality factors in vastly different populations contributes to insight into the basic and universal structure of personality. The present study provides a relevant step in testing whether the GFP reflects a universal personality construct. We consider the label "social effectiveness" as a description of the GFP particularly useful. Previously, it has been suggested that the GFP may reflect "good" versus "bad" personality (Rushton & Irwing, 2011), but from an evolutionary point of view, it may be better to describe the GFP in terms of the effectiveness by which one attains social goals. Individuals who have a good sense of what is socially valued in their society and who can behave in such a way that others think of them as friendly, sociable, and reliable may have some advantages that affect many life domains, such as friendships, romantic relationships, and the attainment of status (e.g., leadership, type of occupation). It may not be difficult to conceive that this would apply to all human societies, ranging from the most developed complex ones, to those that more closely resemble the way humans have lived throughout most of their history (e.g., the Tsimane). As with the general factor of human intelligence, however, having a genetically based species-typical architecture for a trait does not imply having equal levels of that trait (Winegard, Winegard, & Boutwell, 2017). Human biodiversity, as individual and group adaptations to different natural and social environments, is, thus, preserved in the face of the structural constraints of typical human species–wide traits, of which the GFP may possible be one.

Declaration of Conflicting Interests

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