Development and Initial Validation of the BFAS short form with balanced keying (BFAS-SB)

A Thesis

SUBMITTED TO THE FACULTY OF THE UNIVERSITY OF MINNESOTA

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

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2023

Abstract

The Big Five Aspect Scales (BFAS) constitute a hierarchically structured self-report instrument measuring the Big Five and its ten aspects, which are empirically identified subdimensions occupying the level of personality between domains and facets. However, its 100 items may prevent its use in certain contexts and encourage responding with insufficient effort. A short form (BFAS-40) already exists but has several notable flaws. In the current study, we utilized ethnically diverse samples to develop the BFAS-short-balanced (BFAS-SB), a 40-item version of the BFAS with balanced keying across all aspect scales. We believe the BFAS-SB to be well-equipped to measure the trait hierarchy in samples diverse in ethnicity and education levels.

Keywords: Big Five Aspect Scales, Scale Development, Short Form, Construct Validity

Word count: 6,787

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Personality traits describe individual differences in relatively stable patterns of thought, emotion, behavior, and motivation (McAdams & Pals, 2006). Research has shown that personality traits can be organized within a single hierarchy (Markon et al., 2005). Traits describing a broad range of characteristics sit near the top of the hierarchy (e.g., Extraversion, which describes a person's levels of sociability, talkativeness, assertiveness, motivation to seek out rewards, and enjoyment of positive emotions). The dominant empirical taxonomy of broad trait domains—the Big Five—includes Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness/Intellect (Goldberg, 1990; John, 2021). Traits describing a narrower range of characteristics (e.g., energy level, speaking volume) are labeled facets (Costa & McCrae, 2008) or nuances (Mõttus et al., 2017) and sit near the bottom of the hierarchy.

In an effort to better organize the personality hierarchy, DeYoung et al. (2007) factor-analyzed a broad set of facet scales (15 for each of the Big Five), finding empirical support for two correlated subfactors within each Big Five domain. These intermediate traits—labeled personality *aspects*—were thus positioned between facets and domains in the hierarchy, and in terms of bandwidth and predictive validity. Based on these factor analyses, DeYoung et al. (2007) used the International Personality Item Pool (IPIP) to develop the Big Five Aspect Scales (BFAS), a 100-item self-report inventory designed to measure the Big Five and their constituent aspects. In the BFAS, each Big Five trait is divided in the following manner: Extraversion consists of Enthusiasm and Assertiveness, Agreeableness consists of Compassion and Politeness, Conscientiousness consists of Industriousness and Orderliness, Neuroticism consists of Volatility and Withdrawal, and Openness/Intellect consists of Intellect and Openness. The BFAS showed adequate test-retest reliability, internal consistency, and convergent validity with other Big Five instruments (DeYoung et al., 2007; John et al., 1991; Saucier, 1994).

The related but separable nature of the aspects within each Big five domain [between-aspect correlations, r = .33–.59; DeYoung et al. (2007)] has further differentiated the nomological net of personality traits by uncovering associations previously unspecified at the level of the Big Five (Allen et al., 2018; DeYoung et al., 2016; Hirsh et al., 2010; Kaufman et al., 2016; Sun et al., 2018). These empirical findings have also informed Cybernetic Big Five Theory (DeYoung, 2015), a causal theory of personality in which the aspects reflect variations in partially differentiated mechanisms within each Big Five trait. For example, Extraversion is theorized to reflect individual variation in reward sensitivity, but its Enthusiasm aspect mainly reflects variation in sensitivity to hedonic or consummatory rewards (“liking”) whereas its Assertiveness aspect mainly reflects variation in sensitivity to incentive rewards [“wanting”; DeYoung (2013)].

The BFAS is widely used: as of April, 2023, its associated paper (DeYoung et al., 2007) has been cited 2,223 times (Google Scholar). When another widely-used hierarchical Big Five instrument—the second Big Five Inventory [BFI-2; Soto and John (2017b)]—was developed, its facets were intentionally chosen to line up with the BFAS aspects. Despite its wide usage, empirical strengths, and theoretical basis, the BFAS has several limitations. First, its 100 phrased items (e.g., Enthusiasm item, “I make friends easily”) take around 15 minutes to complete, which may be too long for some applications, such as in multi-instrument surveys. For comparison the BFI-2 is just 60 items long and has a short form (BFI-2-S) that is only 30 items long (Soto & John, 2017a, 2017b). Second, the BFAS was developed using samples that were primarily White and Asian, with few participants from other racial-ethnic groups (e.g., Black, Latino). Different groups sometimes exhibit differences in response behavior and item interpretation (Dong & Dumas, 2020; Mõttus et al., 2012). As a result, scales developed using homogenous samples may exhibit altered psychometric properties in other demographic groups. For example, some BFAS items with acceptable psychometrics in the ESCS had lower factor loadings on their intended aspect in university samples [e.g., Orderliness item, “I am not bothered by messy people (reversed)”; DeYoung et al. (2007)]. The current study aimed to address these limitations by developing a short version of the BFAS using more diverse samples and administration contexts.

Current Study

The primary goal of short form development is for the new form to demonstrate adequate validity, both as an independent instrument and in relation to the parent form (Smith et al., 2000). Validation requires the integration of good theory, careful thought, and the appropriate use and interpretation of methods. In addition to common scale development criteria (e.g., content coverage, internal consistency, test-retest reliability, external validity), a valid BFAS short form should preserve the BFAS’s hierarchical multidimensional structure (Clark & Watson, 2019). A short form has already been developed for the BFAS. However, the BFAS-40 (Gallagher et al., 2022) has three major limitations. First, it was not designed with the BFAS’s entire hierarchical structure in mind. Instead, it was designed to optimize the measurement of the individual aspects (and coverage of the facets within each aspect). Second, their development samples were somewhat diverse in age and country representation, but less diverse in race/ethnicity [to our best knowledge, even their most diverse sub-samples had 65% to 70% of their participants identifying as White; Soto and John (2017b); Costello et al. (2017)].

The third and final limitation of the BFAS-40 is the lack of balanced keying in six of its ten 4-item aspect scales. Balanced keying refers to having equal numbers of items keyed in the positive and reversed directions. Unbalanced scales will be impacted by acquiescence bias, a systematic response bias in which people agree to items regardless of item content (Rammstedt et al., 2010). Acquiescent responding adds an additional source of person-specific variance that damages psychometric properties of scales and blurs both the internal correlational structure amongst scales as well as external correlations with criterion variables (Danner et al., 2015; Rammstedt et al., 2010). Acquiescent responding affects the measurement properties of Big Five scales in samples with lower levels of education, which exhibit greater mean levels of acquiescence as well as greater within-sample variability in acquiescence (Rammstedt et al., 2010; Rammstedt et al., 2013).

The current study aimed to address each of these aforementioned limitations by developing a BFAS short form with balanced keying using ethnically diverse samples. As two development samples with distinct features were used, we first tested both their ability to recover the expected five-factor structure and the similarities in their factor structures (Study 1). Then, we developed a 40-item short form of the BFAS with exactly two reverse-keyed items in each 4-item aspect scale (Study 2). The resulting version of the BFAS short form was then validated against a range of criteria, including its ability to preserve its parent form's hierarchical structure (Study 3).

General Method

Materials

The Big Five Aspect Scales [BFAS; DeYoung et al. (2007)] is a 100-item, hierarchically structured instrument designed to measure the Big Five domains and their constituent aspects using items from the IPIP. They are typically assessed with a 5-point Likert scale, but in one sample a 6-point Likert scale was used. Each 20-item domain scale consists of two 10-item aspect scales. The scales exhibit good structural validity, internal consistency, test-retest reliability, and convergence with related personality instruments (DeYoung et al., 2007).

Participants

We made use of two development samples. The first development sample came from publicly available data collected online using the Synthetic Aperture Personality Assessment [SAPA; Condon (2017)] from 2010 to 2017. People complete items on the SAPA website (sapa-project.org/) in exchange for feedback on their personality.

SAPA uses a massively missing completely at random (MMCAR) design to collect data from many personality items, administering a small subset of items to any single individual, reducing participant burden. With an adequately large sample size, inter-item covariances can be calculated and factor-analyzed. All 100 BFAS items were available in the SAPA item pool. However, as seen in Table 1, though 254,829 SAPA participants answered at least one BFAS item, only 13.47 BFAS items were answered on average. The demographics of a subset of N = 207,002 SAPA participants (i.e., the majority of the current SAPA development sample) has previously been described in Revelle et al. (2017). Briefly, those participants were 63% female, with 73% from the U.S., 26 years old on average (SD = 11), and highly educated. Stemming from voluntary web-based data collection, SAPA data are not representative in terms of age and gender, but "represent much greater diversity of subject characteristics than found in the typical university sample" (Revelle et al., 2017, p. 14). We present racial/ethnic group identification data for all samples in Table 2. Note that, in the SAPA dataset, racial-ethnic identification was collected only for U.S. based participants. Thus, the actual level of racial-ethnic diversity in the SAPA dataset was likely slightly greater than was presented in Table 2. The non-U.S. countries with at least 1000 participants in the SAPA dataset were as follows: Canada 10,570; Great Britain 7,205;

Australia 4,787; India 2,778; Sweden 2,425; Germany 2,344; Philippines 2,237; Malaysia 2,149; China 1,440; Netherlands 1,300; Singapore 1,269; Norway 1,167; New Zealand 1,031.

The non-SAPA development sample (N = 3,183) consisted of several samples who were administered the 100-item BFAS in its entirety (using a 5-point Likert scale: Strongly Disagree [1], Disagree [2], Neither Agree nor Disagree [3], Agree [4], Strongly Agree [5]) between 2005 and 2020. After removing careless respondents (defined as those who failed any attention check, or who gave a string of 20 or more identical responses in a row), this sample exhibited a very high level of completeness. More information about this sample is available in Tables 3 and 4.

The Validation sample (N = 3,193) consisted of several samples who were administered the 100-item BFAS in its entirety (using a 5-point Likert scale) between 2015 and 2023. (Note, one University sample, N = 456 was administered a preliminary shortened version of the BFAS containing 64 items.) Participants also completed a number of other self-report and performance measures useful for validation purposes, detailed in Study 3. Participants in this sample do not overlap with those in the non-SAPA development sample. However, in accordance with a cross-validation approach, some of our datasets were divided among the non-SAPA Development and Validation samples. More information about the Validation sample is available in Tables 5 and 6.

Study 1

In this study, we first examined whether the two development samples exhibited the expected five-factor structure. If the five-factor structure were absent in a given sample, the utility of that sample for developing a short form of the BFAS would be limited (see Clark & Watson, 2019). Additionally, given differences in missingness and in the Likert scales between the SAPA and non-SAPA development samples (see Table 1), we tested whether the two development samples exhibited similar factor structures at the level of the two aspect factors within each of the Big Five. (The portion of this research involving separate 2-factor analyses under each of the Big Five was pre-registered at osf.io/tsyx7.) If these samples exhibit similar factor structures, factor-analytic output from both samples could be considered during short form development. Conversely, if the samples exhibit dissimilar factor structures, only the sample that best matches factor-analytic results from previous research (e.g., DeYoung et al., 2007) should be considered during short form development.

A common method for assessing factor structure similarity in Likert-scale data is multiple-group confirmatory factor analysis (CFA), which tests the measurement invariance of *a priori* specified factor structures between groups. If different groups (e.g., females and males) have the same items loading on the same factors, then configural measurement invariance is established (Reise et al., 1993). An example of a factor structure specified *a priori* in personality research is a five-factor model, with each item loading onto a pre-designated factor (e.g., all items belonging to a Neuroticism scale loading onto the Neuroticism factor) and no cross-loadings.

An advantage of measurement invariance testing under the CFA framework is its ease of interpretation: if a model in which factor loadings are constrained to be equal between groups does not fit significantly worse than a model in which the factor loadings are freed, then measurement invariance is present. Common fit statistics used to inform these interpretations include *‰*^{2} from likelihood-ratio tests, relative fit indices like the Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI), and absolute fit indices like the Root Mean Square Error of Approximation (RMSEA) (Reise et al., 1993; Xia & Yang, 2019). Despite this advantage, the lack of simple structure in personality traits leads unidimensional CFA models to fit poorly to personality data (Hopwood & Donnellan, 2010). This is problematic, as a well-fitting baseline model (i.e., the model with the least constraints) is necessary before further invariance testing can be conducted (Reise et al., 1993). The extent of cross-loading in personality scales is typically such that fit indices tend to fall far below conventional cutoffs even after one frees some cross-loadings.

In contrast to CFA, an exploratory factor analysis (EFA) approach allows all items to load on all factors, which better approximates the multidimensional structure of personality items (see Hopwood & Donnellan, 2010). In EFA, the similarity of factor solutions across groups can be assessed using Tucker's congruence coefficient (see Lorenzo-Seva & ten Berge, 2006). After rotating the first group's factor loading matrix to align as closely as possible to that of the second group by a method of least squares, Tucker's congruence coefficient can be computed for each pair of aligned factors. Tucker's congruence coefficients can then be interpreted using conventional cutoffs (e.g., $\varphi = .85$–$.94$ indicates similarity; $\varphi > .95$ indicates equivalence; Lorenzo-Seva & ten Berge, 2006).

Method and Results

All analyses were conducted in *R* (Version 4.2.2) after appropriate reverse-keying of BFAS item responses. The data and analytic code for reproducing these analyses are available at osf.io/qarhv/. All pre-registered analyses were conducted on simulated data prior to the analyses presented here.

Exploratory Factor Analyses at the Five-Factor Level

When DeYoung et al. (2007) created the BFAS, they tested the five-factor structure of the scale by factor-analyzing scale scores on each of the 10 aspects and finding clear five-factor solutions via eigenvalues and factor pattern matrices. Due to the massive missingness of SAPA data, factor analyses in that dataset are best conducted on inter-item covariances, rather than on scale scores. All analyses in study 1 utilized the *fungible* package [version 2.2.2; Waller (2022)]. For both development samples, five factors were extracted from the full set of 100 BFAS items using principal-axis factor extraction followed by varimax rotation. The collated factor loadings from both samples are shown in Table 7.

Table 7 shows clear Neuroticism (factor 1), Agreeableness (factor 3), and Conscientiousness (factor 4) factors in both samples. Despite substantial cross-loadings from Enthusiasm items onto factor 3, an Extraversion factor (factor 2) was also discernible. Lastly, an Openness/Intellect (factor 5) factor was present, albeit with cross-loadings of Openness Aspect items onto factor 3 and Intellect items onto factor 2. Overall, factors 2 and 5 were more clearly marked in the SAPA development dataset. When the BFAS was designed, items marking both aspects equally well were excluded from the scale [e.g., "Have a vivid imagination", which marks both aspects of Openness/Intellect equally well; DeYoung et al. (2007)]. This item exclusion procedure separates the aspects within each of the Big Five but also increases the difficulty of extracting a clean five-factor structure by excluding the most central markers of the Big Five. Despite this structural hurdle, the five factors remained discernible in both samples.

Exploratory Factor Analyses within each Big Five domain and Factor Congruence Calculations

After establishing five-factor structures in the development samples, we explored the similarities of corresponding aspect-level factors between the two development samples. Aspect-level factor loadings can directly inform whether to include or exclude an item from a short form of the BFAS. In a hierarchical instrument like the BFAS, aspect-level factors can be extracted in several ways. We first attempted to simultaneously extract 10 factors from all the items, but found many cross-loadings that were difficult to align. An alternative would be to fit one-factor models separately to each aspect, but this procedure fails to account for the BFAS's hierarchical structure–a key limitation of the approach of Gallagher et al. (2022). We decided to conduct separate EFA's within each Big Five domain, extracting two aspect factors at a time. Although this procedure does not account for cross-loadings across Big Five domains (e.g., an Enthusiasm item on an Agreeableness factor), it does allow items to cross-load onto their non-designated aspect within the same Big Five domain. Items with excessive cross-loadings onto a non-designated aspect should be considered for exclusion (see Study 2). Before further interpretation, we first needed to test whether our development samples contained viable and comparable aspect-level factors.

For both development samples, two factors were extracted from sets of 20 BFAS items assigned to each Big Five domain (each containing two 10-item aspect scales). Whereas the analyses presented in Table 7 attempted to recover the scale's five-factor structure, here the goal was to impose as few constraints as possible to allow factor structures to emerge. Therefore, we extracted the factors using the method of least-squares, then rotated the factors obliquely using an oblimin rotation.

In the SAPA development dataset, factor analyses were based on inter-item covariances. The actual number of pairwise complete observations used to calculated inter-item covariances was substantially smaller than the total sample size, but still quite large, numbering in the thousands. The number of pairwise complete observations among items in each Big Five domain are summarized in Table 8.

Congruence coefficients were used to assess cross-sample factor pair similarity under each Big Five domain. Because congruence coefficients estimate the similarity between pairs of factors, factor pairs must first be aligned correctly. We used the *faAlign* function in *fungible*. This function uses the Hungarian algorithm to perform a targeted rotation with the aim of minimizing a least squares discrepancy function between the two factor pattern matrices. Once aligned, congruence coefficients were calculated as the cosine of the angle between each pair of corresponding factors, (i.e., each pair of vectors; Lorenzo-Seva & ten Berge, 2006). Each Big Five domain yielded two congruence coefficients, one for each pair of aligned aspect factors. These findings are presented in Tables 9–13.

Two general patterns emerged from the findings presented in Tables 9–13: First, in both samples, almost all items loaded more strongly on their designated aspect than on their paired aspect in the same Big Five domain. Second, all but one of the aspect factor congruence coefficients were above .95, suggesting equivalent factors across the SAPA and non-SAPA development samples for these aspects. The Politeness aspect factors exhibited a congruence coefficient of .94, which was still quite high (Lorenzo-Seva & ten Berge, 2006). The correlations between each Big Five domain's two aspects were also fairly similar across the SAPA and non-SAPA development samples, being the highest between the Neuroticism aspects and the lowest between the Openness/Intellect aspects, in line with existing findings (DeYoung et al., 2007).

Discussion

In this study, we tested the appropriateness for short-form development of two different samples differing in missingness, response format, and administration contexts. We found both samples to exhibit an expected five-factor structure (albeit with some potentially poorly-performing items, especially in the non-SAPA development sample). Then, in pre-registered analyses, we found easily interpretible aspect factors emerging from two-factor EFA solutions within each Big Five domain, for both samples. Nine of these aspect factors were considered equivalent across the SAPA and non-SAPA development samples, with the Politeness factors exhibiting "fair" similarity across samples (and missing the "equivalence" criterion of .95 by only

.01). Examining the Politeness factor, we see that some Compassion items had some cross-loadings on this factor and some Politeness items loaded poorly on this factor. This issue was more apparent in the non-SAPA developmental sample, though its effects were mild, and the Politeness factor in this sample remained clearly interpretable.

Why did the SAPA development sample exhibit slightly better measurement properties than the non-SAPA development sample in the five-factor solution and in some of the two-factor solutions? Several plausible reasons exist. First, participants in the SAPA sample were a self-selected group who were presumably highly motivated to provide accurate responses to receive better feedback about their personality. In contrast, those in the non-SAPA sample completed the BFAS for extra credit and/or monetary payments, which may have led to lower-quality responses. (We filtered out the participants who failed attention checks or who responded identically to consecutive items, but could not detect more subtle forms of insufficient-effort responding.) Second, participants in the SAPA sample generally completed a smaller number of items and could choose when to terminate responding, which may also have encouraged careful responding. Third, the SAPA's 6-category Likert scale may have yielded better measurement properties than the non-SAPA development dataset's 5-category Likert scale on some items. While we do not have the data to test these possibilities, they highlight the importance of running factor analyses across different types of samples. A potential implication of these sample differences is to remove the non-SAPA development dataset from consideration when creating the short form. However, we decided to retain both samples in short form development, as the measurement properties in the non-SAPA development sample remained acceptable, and because it is more similar in its features to the scenarios in which the BFAS was developed (DeYoung et al., 2007) and in which a BFAS short form is most likely to be used.

The main limitation of the current study was that we did not control for the effectsof acquiescence bias (yea-saying), which can influence measurement properties like factor loadings (Danner et al., 2015; Rammstedt et al., 2010; Rammstedt et al., 2013). Given the relatively balanced keying of the BFAS, the influence of acquiescence should be bias should be minimized for scale scores, but it may nonetheless be worth considering in item selection. For the purposes of testing factor structure similarity, EFA's were likely appropriate, but should we wish to consider factor loadings in short form development, acquiescence should be modeled. We do so in Study 2, in which we develop a 40-item short form for the BFAS

Study 2

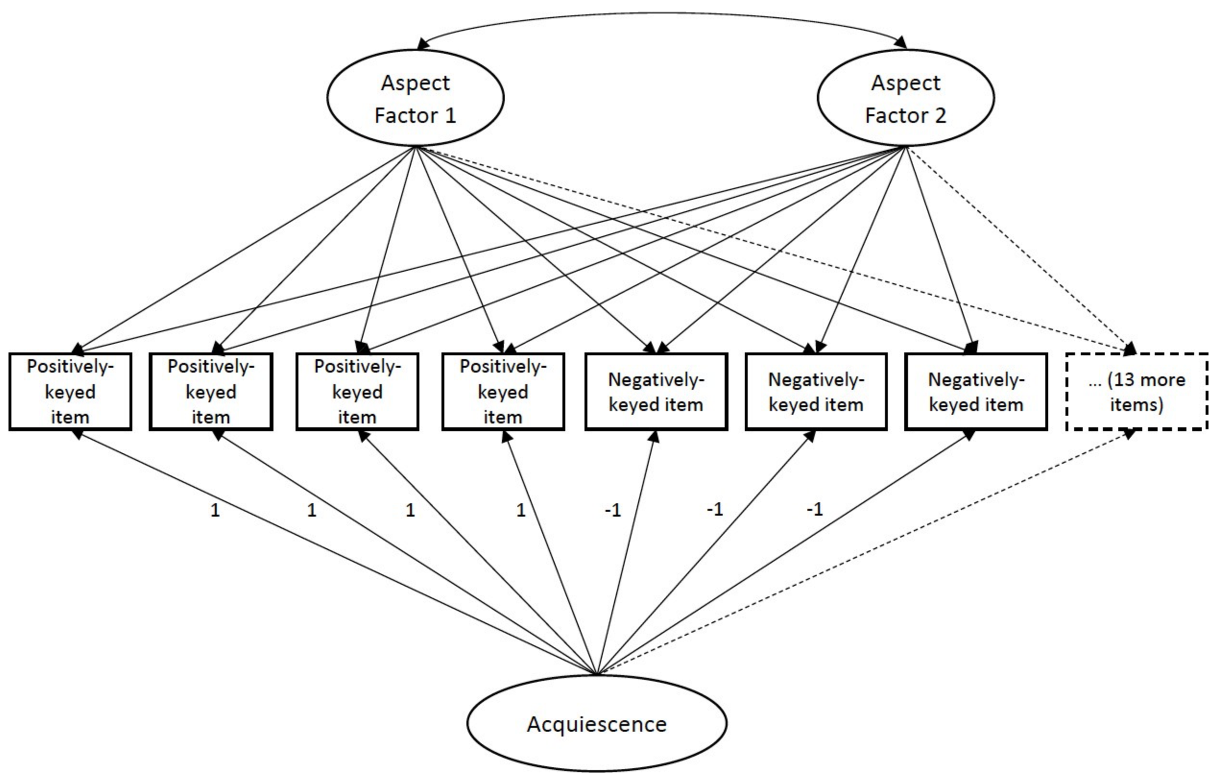
Having assessed the viability and comparability of both development samples, we next sought to develop a short form of the BFAS according to several criteria. Given the potential impacts of acquiescent responding on personality measurement, especially in less-educated populations (Danner et al., 2015; Rammstedt et al., 2010; Rammstedt et al., 2013), we set an *a priori* criterion for balanced-keying in all aspect and domain scales. We aimed for all ten aspect scales to be 4 items long (two forward-keyed items and two reverse-keyed items). This set up our scale for direct comparison with the BFAS-40 (Gallagher et al., 2022), which did not enforce balanced-keying in six of their ten aspect scales.

Separately for each of the Big Five domains (and separately for the two developmental samples), we fit exploratory structural equation models (ESEM)—which combine the strengths of EFA and CFA frameworks—to the data. As in Study 1, we extracted 2 exploratory aspect factors per Big Five domain. In addition, items loaded on a keying factor, which was set to be orthogonal to the aspect factors. With balanced keying and breadth of content coverage in mind, we selected items based on their patterns of factor loadings in the resulting pattern matrix.

Method and Results

All analyses were conducted in *MPlus* [version 8.7; Muthén and Muthén (2017)]. In both SAPA and non-SAPA development samples, we fit five separate ESEM's (one for each Big Five domain). We used Weighted Least Squares—Mean and Variance adjusted (WLSMV) estimation, which is designed for ordinal data and robust to deviations from normality (DiStefano & Morgan, 2014). Each set of 20 items (10 from each aspect within the same Big Five domain) loaded freely on two exploratory factors (one for each aspect). These exploratory factors were rotated using oblimin rotation. In addition, all 20 items loaded on an acquiescence factor with the magnitude of the loading constrained to be equal for all items [under the assumption that acquiescence bias is a stable tendency within individuals; Danner et al. (2015)], and the sign of the loading constrained to match the item's keying direction (after negatively-keyed items were reverse-scored). The acquiescence factor was fixed to be orthogonal to both exploratory factors. An example of our model is depicted in Figure 1. Using a somewhat simpler model than ours, Asparouhov & Muthén (2009) have demonstrated that samples of $N = 500$ led to acceptable parameter estimates. Since our samples had several thousand pairwise complete observations, our parameter estimates were likely to be relatively unbiased. Judging by absolute (RMSEA) and relative fit indices (CFI, TLI) presented in Table 14, the SAPA ESEM models fit the data better than the non-SAPA ESEM models. Individual ESEM results are presented in Tables 15–19.

Figure 1 Visualization of Exploratory Structural Equation Model fit to each set of paired aspects.



Note. For simplicity, only 7 of the 20 items per big five domain are shown in the diagram above.

After conducting the ESEM's, the first and senior authors created the BFAS-SB (BFAS short form with balanced keying) using the following criteria. First, each aspect scale should retain 4 items (2 positively-keyed, 2 negatively-keyed). Second, higher factor loadings were prioritized, unless there appeared to be substantial content overlap between items with high factor loadings. Third, if an item cross-loaded onto the aspect factor it was not assigned to, if the absolute magnitude of this cross-loading exceeded .3 in one development sample—or if it exceeded .2 in both development samples—the item was excluded from the short form. Fourth, to maintain breadth of content coverage, items were retained with a number of theoretically-informed facets in mind (identified *ad hoc* from the original BFAS items). Within the Withdrawal aspect, the facets we considered for content coverage were *anxiety*, *depression*, and *self-consciousness*; Within Volatility, the facets we considered for content coverage were *anger*, *emotional lability*, and *upset*. Within the Compassion aspect, the facets we considered for content coverage were *empathy*, *sympathy*, and *acts of love*. Within Politeness, the facets we considered for content coverage were (lack of) *aggression*, *honesty-humility*, and (lack of) *exploitation*. Within the Industriousness aspect, the facets we considered for content coverage were (lack of) *distractibility*, (lack of) *procrastination*, and *e ciency*. Within Orderliness, the facets we considered for content coverage were (lack of) *fastidiousness*, *attachment to routine*, and *punctuality*. Within the Enthusiasm aspect, the facets we considered for content coverage were *sociability* and *positive emotions*. Within Assertiveness, the facets we considered for content coverage were *leadership*, *decisiveness*, and *persuasiveness*. Within the Intellect aspect, the facets we considered for content coverage were *confidence in intellectual speed*, *confidence in intellectual capacity)* and *intellectual engagement*. Within the Openness aspect, the facets we considered for content coverage were *aesthetics*, *fantasy*, and *artistic creativity*. Disagreements between the two authors were resolved by discussion. The final selected items are presented in Table 20.

Discussion

The 40-item BFAS-short form with balanced keying (BFAS-SB) were developed with the parent form's hierarchical structure in mind (Clark & Watson, 2019), using responses from two relatively diverse samples with differing Likert scales, administration contexts, and levels of missingness. By modeling acquiescent responding in an exploratory structural equation modelling (ESEM) framework, we were able to place items on equal footing, regardless of item keying, within factor pattern matrices. This allowed us to select optimal sets of 4 items per aspect scale, combining high primary loadings, low cross-loadings, and broad content coverage. These items were selected such that 2 of the items in each scale are positively-keyed and 2 of the items in each scale are reverse-keyed, which should make the BFAS-SB appropriate across samples with differing levels of educational attainment (see Rammstedt et al., 2010).

In line with the trends observed in Study 1, the SAPA sample yielded better-fitting ESEM's than the non-SAPA development sample. Potential explanations for this finding were explored in the Discussion section of Study 1. Interestingly, despite better fit, two SAPA sample items displayed unexpected loading patterns. In the SAPA but not the non-SAPA development sample, the Volatility items, "(I) change my mood a lot", and "(I) am a person whose moods go up and down easily", loaded more strongly on the factor marked by Withdrawal items than on the factor marked by Volatility items. This pattern was not particularly concerning—as the Neuroticism aspects tend to be highly correlated anyway (DeYoung et al., 2007)—but it reiterates the importance of testing scales in different samples. (These two items were excluded from the BFAS-SB Volatility scale.)

Two items did not perform as expected across both samples. First, the Orderliness item "(I) follow a schedule" loaded almost equally on the Orderliness and Industriousness factors. Second, the Intellect item "(I) avoid philosophical discussions (reversed)" loaded more strongly on the Openness factor than on the Intellect factor. These trends suggest potential changes in participants' understanding of these items from the samples used to develop the BFAS to the samples used to develop the BFAS-SB.

We modified two of the original Openness aspect items, "seldom daydream" and "seldom notice the emotional aspects of paintings and pictures" to begin with "rarely" instead of "seldom". We made this change for all instances of "seldom" in the original BFAS some years ago, after finding that a number of participants did not understand the word "seldom" correctly. In general, use of the word "seldom" has decreased compared to the word "rarely" according to Google Ngram, and some of our unpublished work has shown that items beginning with "seldom" tended to exhibit measurement non-invariance across participants of differing racial-ethnic and/or gender identification. Although it would be good to test formally for improvement, this change should improve item performance and lead to better measurements.

Study 3

Having created the BFAS-SB, we next sought to validate it according to the model of Construct Validity outlined by Loevinger [substantive validity, structural validity, and external validity; Loevinger (1957)] and operationalized by Clark & Watson (2019). In line with an iterative approach to psychometric evaluation, we have already established some substantive and structural validity for the BFAS-SB by testing the BFAS's multidimensional factor structure across samples in Study 1 and by prioritizing content coverage and balanced keying in Study 2. The current study seeks to further the substantive and structural validity of the BFAS-SB—as well as test its external validity—in the held-out Validation sample. Considering the BFAS-SB by itself, we sought to examine the properties of individual BFAS-SB items, evaluate the BFAS-SB's levels of scale unidimensionality and test-retest reliability, and assess the BFAS-S-BB's hierarchical multidimensional structure. Then, we examined relations between the BFAS-SB and the 100-item BFAS as compared with the BFAS-40 (Gallagher et al., 2022).

For external validity, we examined convergent and discriminant correlations between the BFAS-SB and (1) another measure of the Big Five, the second Big Five inventory [BFI-2; Soto and John (2017b)]; (2) dimensional measures of psychopathological traits, including the Personality Inventory for the DSM-5 [PID-5; Krueger et al. (2012)], the Comprehensive Assessment of Traits relevant to Personality Disorder, static form [CAT-PD; Simms et al. (2011)], the Narcissism Admiration and Rivalry Questionnaire [NARQ; Back et al. (2013)], and the Autism-Spectrum Quotient [AQ; Baron-Cohen, Wheelwright, Skinner, et al. (2001)]; (3) measures of well-being and distress, including the Psychological Well-Being scale (Ryff, 1989), the Rosenberg Self-Esteem Scale (Rosenberg, 1965), and the Kessler Psychological Distress Scale (Andrews & Slade, 2001); (4) self-report and performance-based measures of social cognition and social relationships, including the affiliation scale (see DeYoung et al., 2013), the Lubben Social Network Scale-Revised (Lubben, 1988), the Reading the Mind in the Eyes test-revised [RMET; Baron-Cohen, Wheelwright, Hill, et al. (2001)], the Animated Triangles Test (Abell et al., 2000), and the Imposing Memory Test (Kinderman et al., 1998); (5) a performance-based measure of Intelligence, the International Cognitive Ability Resource, 16-item version [ICAR; Condon and Revelle (2014); Dworak et al. (2021)]. These convergent and discriminant correlations were compared to those of the 100-item BFAS as well as those of the BFAS-40 (Gallagher et al., 2022).

Method

Materials

Due to the large number of measures included in the current study, we include descriptions of two of the most important hieararchical multidimensional measures of personality and psychopathology below. All other measures are listed in the previous paragraph.

The Second Big Five Inventory [BFI-2; Soto and John (2017b)]. The BFI-2 is a 60-item hierarchical self-report Big Five instrument with three facets per Big Five domain (15 facets total). Each facet is measured using four items (2 positively-keyed, 2 negatively-keyed), on a 5-point Likert scale (1 = Disagree strongly, 2 = Disagree a little, 3 = Neutral; no opinion, 4 = Agree a little, 5 = Agree strongly). The BFI-2 was validated in several large samples (Soto & John, 2017b). In the Validation dataset, N = 1,457 participants completed the BFI-2 (1,000 female).

The Personality Inventory for DSM-5 [PID-5; Krueger et al. (2012)]. The PID-5 is a 220-item hierarchical self-report measure of pathological levels of personality traits targeting Section III (alternative model of personality disorders) of the Diagnostics and Statistics Manual, fifth edition [DSM-5; *Diagnostic and Statistical Manual of Mental Disorders* (2013)]. It measures five higher-order factors (Negative affect, Antagonism, Disinhibition, Detachment, and Psychoticism) which correspond to extreme levels of Big Five traits, as well as 25 lower-order facets. Because the the full PID-5 was not always administered in the Validation dataset, N = 1,284 participants had domain-level scores on the PID-5, (929 female), except for negative affect, N = 947. The average number of participants with valid facet-level data was 800.92 (range: 535 to 1286), with some facets of antagonism (i.e., deceitfulness, grandiosity, manipulativeness) represented by the largest number of participants.

Results

Item properties of the BFAS-SB are presented in Table 21. After appropriate reverse-keying, most items had mean scores above the midpoint in the Likert scale (except for some Neuroticism items and one Industriousness item). Most variables were negatively (left) skewed, with items with a mean score around 4 (e.g., Compassion item "(I) Sympathize with others' feelings") demonstrating more severe skew. Interestingly, only 19 of the items in the BFAS-40 (Gallagher et al., 2022) were represented in the BFAS-SB, and no aspect scale completely overlapped between the two short-forms.

Scale properties of the BFAS-SB are presented in Table 22. Overall, the BFAS-SB scales exhibit good part-whole correlations as well as test-retest reliability (according to intraclass correlation estimates). Average inter-item correlations all fell within the $.15 \leq r \leq .50$ range suggested by Clark and Watson (2019), with the Big Five domains having lower values, as expected. The Politeness and Orderliness aspects' inter-item correlations were lower than expected given their position in the personality hierarchy. (Aspects, as a level below the Big Five domains, should be more unidimensional than the Big Five domains, with higher inter-item correlations.) The scales tended to perform poorly according to w_h and α, whereas Revelle's unidimensionality estimates (see here) suggested a lack of unidimensionality in the BFAS-SB's Politeness and Compassion aspect scales. For comparison, The BFAS-40's Politeness and Compassion aspects had Revelle's unidimensionality estimates of 0.65 and 0.89, respectively.

With regards to structural validity, as seen in Table 23, in contrast to the five-factor solution in the two development datasets (see study 1), aside from Neuroticism (f1), the five-factor structure does not appear to be present in the BFAS-SB. The short-form full-scale correlational patterns seen in Table 24 do not seem to be drastically different between the two short forms. As seen in Table 25, there did not appear to be major differences in the correlational patterns between the BFAS and the BFI-2, regardless of the scale used (full scale, BFAS-40, or BFAS-SB).

Tables 26 presents correlations between three versions of the BFAS and the PID5 scales. Table 27 presents correlations between the three versions of the BFAS and all external validity criteria. Lastly, Table 28 summarizes the findings in Table 27 by calculating congruence coefficients between the patterns of external validity correlations of each version of the BFAS. Judging by Table 28, the politeness scales in both short forms failed to adequately capture the correlational patterns between the 100-item BFAS and various external criteria. In addition, the BFAS-SB's Orderliness and Compassion scales did not capture the 100-item BFAS's correlations with external criteria as well as corresponding scales in the BFAS-40 did. (As a reminder, the three BFAS-SB scales—Politeness, Orderliness, and Compassion—exhibited certain flaws when examined alone, as seen in Table 22.)

Discussion

Using a wide range of self-report and performance-based validation criteria, the current study aimed to validate the BFAS-SB in terms of its substantive, structural, and external validity

(Loevinger, 1957). Considered individually, most BFAS-SB aspect scales had adequate psychometric properties. Structurally, however, the BFAS-SB failed to recover the proposed 5-factor structure (Table 23). Moreover, the BFAS-SB's Compassion and Orderliness aspect scales sometimes did not perform as well as their counterparts from the BFAS-40 (Gallagher et al., 2022), when considering their ability to recover features of the BFAS-100. (Both short forms had inadequate Politeness scales.)

Further tests of the BFAS-SB's adequacy might include fitting 5-factor and 2-factor ESEM's to account for acquiescence and test the scale's hierarchical structure, as well as testing the scale's properties in the SAPA dataset (keeping in mind the potential bias this may introduce). The current findings indicate that the BFAS-SB mostly performs adequately, although not always better than the BFAS-40 in some psychometric criteria.

It is worth noting that neither the current version of the BFAS-SB nor the BFAS-40 utilized item response theory (IRT) in scale construction (see Maples et al., 2015; Morizot et al., 2007). IRT can help scale developers create scales that measure accurately across a range of potential latent trait levels (Clark & Watson, 2019). Since negatively-keyed items often peak at a different mean level than positively-keyed items (see Table 21 for example), enforcing balanced-keying may help researchers select a set of items that better measure a wider range of potential latent trait levels. The tradeoffs between balanced-keying and known impacts of negatively-keyed items on scale unidimensionality (Wang et al., 2015) remains to be studied.

General Discussion

Using large, ethnically diverse datasets with differing measurement properties, we developed a short form for the Big Five Aspect Scales [BFAS; DeYoung et al. (2007)]—a hierarchically structured instrument for measuring normative personality variation. The BFAS short-form with balanced keying (BFAS-SB) was developed with the importance of this hierarchical structure in mind. We first found reasonable support for a five-factor structure in both our development samples, then found stronger support for a replicable two-factor structure within each Big Five domain. We moved forward to develop the 40-item BFAS-SB while keeping acquiescence bias, content breadth, and balanced keying in mind. This procedure yielded 4-item aspect scales with acceptable psychometric properties when considered in isolation (except for the Politeness aspect scale). However, we failed to recover the expected 5-factor structure. In addition, our Compassion and Orderliness scales appeared to possess lower levels of unidimensionality than their counterparts in the BFAS-40 (Gallagher et al., 2022). Since strict unidimensionality is not desirable above the facet level, this was not necessarily a limitation of the BFAS-SB. Given that balanced keying tends to impair certain psychometric indices in order to improve validity, we would still recommend using the BFAS-SB.

In developing the BFAS-SB, we saw several flaws with the BFAS-40 that we wished to remedy. The primary flaw that we observed was the lack of balanced keying across most aspect scales, as well as the paucity of attention paid to preserving the hierarchical structure of the parent form. Though we were not able to recover a five-factor structure from the short form, it is worth noting that DeYoung et al. (2007) recovered this structure from scale scores—which is easier than recovering the structure from item scores, as individual items can cross-load onto other factors. Perhaps fitting exploratory structural equation models (ESEM's) or testing for the factor structure in the SAPA dataset (Condon, 2017)—which appeared to have 'cleaner' factors overall—could help elucidate the causes behind the scales that have less desirable psychometric properties in the BFAS-SB.

Scale development is a science and an art, driven by a number of potentially incommensurate criteria and qualitative decisions. Based on empirical and theoretical evidence from other scale development efforts, we created a scale that we believe should function better across a more diverse range of racial-ethnic groups and levels of educational attainment than other version(s) of the BFAS. However, this proposition remains to be tested empirically. Formal measurement invariance testing, based on ESEM and/or item response theory (IRT), could elucidate our claims (see Dong & Dumas, 2020; Hughes et al., 2021; Marsh et al., 2013; Ock et al., 2020). We have some existing data to test claims regarding measurement invariance, though more fine-grained measures beyond group membership (e.g., level of identification with one's ethnicity) should be preferred in future data collection efforts (Syed, 2021). Whether the reseacher or applied user chooses to administer the BFAS-SB or the BFAS-40 may not matter at the group level, but there could be certain underserved individuals who receive more accurate measures (and potentially feedback) with our version.

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Table 1

Table of sample demographics for participants in all samples.

Dataset	N	Age (SD)	% Female	% White	% Missing	Likert Scale	Mean BFAS (SD)
SAPA Development	254,829	25.95 (10.73)	62.71%	62.35%*	6.58%*	1-6	13.47 (7.19)
non-SAPA Development	3,183	24.35 (7.40)	59.91%	51.43%	11.12%	1-5	99.52 (4.24)
Validation	3,193	23.23 (10.73)	70.28%	62.20%	0.00%	1-5	94.79 (12.64)

Note. *in this sample, only U.S. based participants provided data on their racial-ethnic identification. % Missing = % of participants missing ethnic identification data. Mean BFAS (SD) = Mean number of BFAS items completed, out of 100.

Table 2

Table of Racial-Ethnic group identification data for all samples used in the study.

Racial-Ethnic Identification	SAPA Development N (%)	non-SAPA Development N (%)	Validation N (%)
Asian	7,939 (4.71%)	400 (12.57%)	553 (17.32%)
Black	15,658 (9.29%)	356 (11.18%)	264 (8.27%)
Latino	14,841 (8.81%)	331 (10.40%)	205 (6.42%)
Mixed	9,941 (5.90%)	2 (0.06%)	145 (4.54%)
Native American	1,245 (0.74%)	9 (0.28%)	5 (0.16%)
Native Hawaiian/Pacific Islander	405 (0.24%)	1 (0.03%)	3 (0.09%)
Other	2,345 (1.39%)	93 (2.92%)	32 (1.00%)
White	105,087 (62.35%)	1,637 (51.43%)	1,986 (62.20%)
Missing	11,088 (6.58%)	354 (11.12%)	0 (0.00%)

Note. In the SAPA Development sample, only U.S. based participants provided data on racial-ethnic identification.

Table 3

Age and Gender Details on Samples Constituting the non-SAPA Development Dataset

Source	N	Mean Age	SD (Age)	Female	Male	No Gender	Other
New Haven, University	335	26.34	5.09	165	170	0	0
MTurk 1	427	29.83	10.00	213	209	5	0
Minnesota, University 1	151	20.96	2.26	112	39	0	0
Ontario, University	478	19.32	3.33	299	178	1	0
MTurk 2	251	34.43	11.45	138	113	0	0
Minnesota, University 2	74	19.61	1.67	53	21	0	0
Qualtrics	784	24.25	3.84	588	170	9	17
Minnesota, University 3	446	19.90	2.46	339	99	5	3
New Haven, Community	237	23.52	4.98	0	237	0	0

Note. Half of the participants in MTurk 2 and Minnesota, University 2 and two-thirds of the participants in Qualtrics and Minnesota, University 3 were randomly allocated to this development dataset, with the remainder allocated to the validation dataset for cross-validation purposes. No Gender = data on gender identification not provided.

Table 4

Ethnic Identification of Samples Constituting the non-SAPA Development Dataset

Source	Asian	Black	Latino	Mixed	Other	White	NatAm	NaHa/Pa
New Haven, University	15	25	12	3	28	250	2	0
MTurk 1	153	12	13	3	30	214	2	0
Minnesota, University 1	21	4	3	0	2	121	0	0
Ontario, University	86	7	2	0	5	28	348	2
MTurk 2	15	18	10	2	11	195	0	0
Minnesota, University 2	8	2	2	0	4	58	0	0
Qualtrics	0	258	271	0	0	255	0	0
Minnesota, University 3	102	30	18	1	13	279	2	0
New Haven, Community	0	0	0	0	0	237	0	0
Total	400	356	331	9	93	1,637	354	2

Note. Half of the participants in MTurk 2 and Minnesota, University 2 and two-thirds of the participants in Qualtrics and Minnesota, University 3 were randomly allocated to this development dataset, with the remainder allocated to the validation dataset for cross-validation purposes. NatAm = Native American; No Eth = data on ethnic identification not provided; NaHa/Pa = Native Hawaiian/Pacific Islander.

Table 5

Age and Gender Details on Samples Constituting the Validation Dataset

Source	N	Mean Age	SD (Age)	Female	Male	Other	No Gender
Minnesota, University 4	401	20.23	3.24	289	110	2	0
Minnesota, University 5	388	26.93	10.30	219	166	3	0
Minnesota, University 6	414	19.86	2.53	315	88	11	0
MTurk 2	247	35.73	12.77	135	112	0	0
Minnesota, University 2	78	20.18	2.94	53	25	0	0
Minnesota, University 7	258	18.79	0.83	185	72	1	0
Qualtrics	401	24.53	3.90	278	113	6	4
Minnesota, University 3	215	20.09	2.20	156	56	1	2
Minnesota, University 8	335	26.56	13.78	266	68	1	0
Minnesota, University 9	456	19.91	2.33	348	94	14	0

Note. Half of the participants in MTurk 2 and Minnesota, University 2 and two-thirds of the participants in Qualtrics and Minnesota, University 3 were randomly allocated to the non-SAPA development dataset, with the remainder allocated to this validation dataset for cross-validation purposes. No Gender = data on gender identification not provided.

Table 6

Ethnic Identification of Samples Constituting the Validation Dataset

Source	Asian	Black	Latino	Mixed	Other	White	NatAm	NaHa/Pa
Minnesota, University 4	119	10	9	25	5	233	0	0
Minnesota, University 5	91	27	8	21	2	237	2	0
Minnesota, University 6	86	25	9	29	3	262	0	0
MTurk 2	20	17	13	0	3	191	2	1
Minnesota, University 2	3	4	3	0	6	62	0	0
Minnesota, University 7	35	5	6	10	1	201	0	0
Qualtrics	0	131	133	0	0	137	0	0
Minnesota, University 3	55	14	7	0	7	130	1	1
Minnesota, University 8	59	7	4	28	0	236	0	1
Minnesota, University 9	85	24	13	32	5	297	0	0
Total	553	264	205	145	32	1,986	5	3

Note. Half of the participants in MTurk 2 and Minnesota, University 2 and two-thirds of the participants in Qualtrics and Minnesota, University 3 were randomly allocated to the non-SAPA development dataset, with the remainder allocated to this validation dataset for cross-validation purposes. NatAm = Native American; No Eth = data on ethnic identification not provided; NaHa/Pa = Native Hawaiian/Pacific Islander.

Table 7

Five-factor Exploratory Factor Analysis Pattern Matrix in both Development Samples

Item Labels	f1 nS	f1 S	f2 nS	f2 S	f3 nS	f3 S	f4 nS	f4 S	f5 nS	f5 S
bfas_1R	.30	.41	-.19	-.25	.03	.00	-.05	-.10	.24	.13
bfas_11	.57	.55	-.24	-.35	.06	-.02	-.16	-.16	-.07	.08
bfas_21R	.42	.46	-.43	-.42	-.08	-.06	-.08	-.15	.11	-.01
bfas_31	.57	.55	-.17	-.29	-.02	-.01	-.09	-.09	-.20	-.03
bfas_41R	.52	.52	-.25	-.30	.04	-.01	-.07	-.15	.25	.18
bfas_51	.55	.59	-.21	-.23	.23	.16	.05	.12	-.07	.00
bfas_61	.59	.52	-.29	-.40	-.01	.03	-.18	-.20	-.19	-.13
bfas_71R	.31	.38	-.42	-.41	.08	.07	.10	.04	.03	-.05
bfas_81	.56	.55	-.20	-.30	.12	.14	-.06	-.06	-.20	-.07
bfas_91	.52	.52	-.24	-.34	.06	.08	-.05	-.03	-.28	-.11
bfas_6	.68	.71	.08	.13	-.24	-.22	-.01	.00	-.05	-.10
bfas_16R	.54	.64	-.07	.04	-.06	-.10	.07	.05	.26	-.04
bfas_26	.73	.76	-.05	-.05	-.10	.02	.00	.02	-.07	-.09
bfas_36R	.49	.57	-.18	.00	-.02	.13	-.05	-.15	.14	-.13
bfas_46	.67	.69	.02	-.04	-.04	-.01	-.08	-.13	-.08	.01
bfas_56R	.45	.54	-.06	.03	-.11	.02	-.01	-.10	.15	-.17
bfas_66	.73	.75	-.03	-.11	-.03	.01	-.07	-.12	-.02	.03
bfas_76R	.56	.62	-.10	.04	-.08	-.15	.12	.05	.21	-.05
bfas_86	.72	.75	-.01	.03	-.18	-.12	-.05	.01	-.05	-.06
bfas_96	.64	.70	.07	.08	-.09	.02	-.04	-.03	-.06	-.07
bfas_2R	-.11	-.02	-.05	.07	.48	.57	.03	-.02	.15	.04
bfas_12	.12	.09	.11	.10	.56	.62	.03	.04	-.03	.10
bfas_22	-.03	.02	.18	.18	.61	.64	.05	.11	-.01	.05
bfas_32R	-.19	-.07	-.08	.03	.53	.63	.06	.06	.24	.06
bfas_42	-.01	.04	.10	.05	.68	.73	.06	.06	-.03	.05
bfas_52R	-.15	-.04	-.10	-.03	.54	.65	.05	.02	.31	.09
bfas_62R	-.20	-.09	.01	.13	.55	.57	.10	.08	.24	.00

Table 7 continued

Item Labels	f1 nS	f1 S	f2 nS	f2 S	f3 nS	f3 S	f4 nS	f4 S	f5 nS	f5 S
bfas_72	-.01	.07	.16	.18	.62	.62	.01	.01	-.05	.03
bfas_82R	-.08	.07	-.08	-.04	.54	.49	.06	-.04	.22	.05
bfas_92	-.05	-.02	.15	.12	.59	.63	.07	.12	-.03	.01
bfas_7	-.10	-.02	-.01	-.03	.22	.31	.42	.42	-.30	-.26
bfas_17R	-.07	-.08	-.35	-.20	.33	.40	.15	.08	.09	-.20
bfas_27	.06	.01	-.18	-.34	.36	.32	.07	.00	-.11	.04
bfas_37R	-.23	-.20	-.22	-.16	.41	.48	.25	.21	.18	-.03
bfas_47	-.04	-.13	-.19	-.38	.20	.26	.07	.03	-.15	.02
bfas_57	-.17	-.18	-.17	-.31	.26	.24	.06	-.02	-.18	-.02
bfas_67R	-.36	-.33	-.19	-.21	.38	.43	.26	.18	.05	.02
bfas_77R	-.26	-.24	-.26	-.29	.36	.36	.23	.18	.17	.01
bfas_87R	-.23	-.14	-.35	-.35	.30	.28	.18	.10	.12	.00
bfas_97R	-.22	-.13	-.24	-.14	.34	.43	.07	.07	.16	.03
bfas_3	-.22	-.19	.31	.34	.12	.09	.42	.54	-.01	.10
bfas_13R	-.35	-.28	.14	.23	.04	.10	.51	.52	.14	-.03
bfas_23R	-.33	-.27	.13	.20	.01	.04	.51	.55	.21	.01
bfas_33R	-.46	-.43	.13	.19	.03	.01	.40	.42	.18	.09
bfas_43	-.23	-.19	.31	.24	.12	.10	.50	.59	-.05	.01
bfas_53R	-.27	-.22	.07	.15	.15	.09	.37	.48	.33	.13
bfas_63	-.14	-.11	.35	.34	-.02	-.02	.38	.46	.01	.09
bfas_73	-.21	-.26	.37	.26	-.12	-.09	.31	.41	-.11	.14
bfas_83R	-.30	-.27	.19	.29	-.07	-.01	.35	.41	.16	.00
bfas_93R	-.40	-.36	.14	.06	-.12	-.09	.39	.43	.21	.09
bfas_8R	-.17	-.15	-.06	-.03	-.02	-.03	.52	.50	.13	-.05
bfas_18	.04	.09	.04	-.01	.11	.08	.51	.64	-.06	.02
bfas_28	-.04	-.06	.10	.08	.06	.06	.60	.64	-.12	-.04
bfas_38	-.05	.00	.16	.10	.06	.10	.57	.62	-.16	-.06
bfas_48R	.09	.12	-.08	.00	-.01	-.02	.39	.42	.15	-.05

Table 7 continued

Item Labels	f1 nS	f1 S	f2 nS	f2 S	f3 nS	f3 S	f4 nS	f4 S	f5 nS	f5 S
bfas_58	.26	.29	.12	-.02	.10	.05	.42	.40	-.16	.03
bfas_68R	.09	.15	-.09	-.06	.04	.06	.47	.43	.14	-.04
bfas_78R	.00	.05	-.12	-.09	.13	.08	.50	.44	.03	-.15
bfas_88	.02	.04	.08	-.01	.11	.16	.37	.49	-.23	-.10
bfas_98	.20	.20	.19	.05	.07	.02	.43	.51	-.10	.10
bfas_4	-.24	-.16	.50	.57	.26	.33	.01	.03	-.20	-.17
bfas_14R	-.27	-.16	.19	.37	.29	.34	.08	.02	-.01	-.30
bfas_24R	-.39	-.21	.20	.39	.24	.37	.08	.00	.00	-.26
bfas_34R	-.18	.02	.14	.35	.24	.30	-.01	-.10	.07	-.19
bfas_44	-.20	-.10	.41	.45	.34	.43	-.01	-.04	-.22	-.16
bfas_54R	-.04	.12	.11	.33	.34	.31	.02	-.12	.14	-.11
bfas_64R	-.21	-.10	.28	.47	.37	.38	.09	.04	.17	.00
bfas_74	-.08	.06	.33	.39	.43	.49	.07	.04	-.12	-.10
bfas_84	-.22	-.18	.46	.52	.33	.29	-.01	.02	-.14	-.10
bfas_94	-.12	-.06	.36	.42	.40	.34	-.05	-.02	-.13	-.07
bfas_9	-.08	-.05	.65	.65	.00	.03	.17	.26	.10	.15
bfas_19	.03	.03	.63	.63	.03	.04	.04	.10	.07	.16
bfas_29R	-.22	-.13	.43	.57	.14	.11	.07	.09	.35	.20
bfas_39	-.08	-.05	.63	.60	.09	.16	.00	.02	-.01	.16
bfas_49R	-.19	-.18	.42	.57	-.01	-.04	.15	.16	.37	.19
bfas_59	-.13	-.11	.66	.65	.07	.08	.14	.25	.04	.13
bfas_69	.02	.00	.54	.53	.04	-.01	-.09	.00	.00	.20
bfas_79R	-.11	-.01	.35	.51	.02	-.01	.04	-.01	.35	.06
bfas_89	-.09	-.07	.61	.57	.01	.08	.11	.15	.06	.15
bfas_99R	-.08	-.04	.44	.55	-.03	-.04	.06	.10	.28	.08
bfas_5	-.22	-.16	.42	.24	.11	-.01	.13	.14	.20	.54
bfas_15R	-.25	-.19	.16	.09	.18	.02	-.01	-.09	.50	.58
bfas_25	-.18	-.17	.39	.26	.08	-.04	.19	.20	.24	.50

Table 7 continued

Item Labels	f1 nS	f1 S	f2 nS	f2 S	f3 nS	f3 S	f4 nS	f4 S	f5 nS	f5 S
bfas_35	-.10	-.16	.33	.12	.08	-.09	.04	.08	.24	.54
bfas_45R	-.12	-.07	.10	.11	.24	.05	-.10	-.17	.47	.49
bfas_55R	-.20	-.16	.10	.03	.17	.02	.06	.02	.51	.54
bfas_65	-.08	-.04	.32	.14	.12	.02	.00	-.03	.33	.58
bfas_75	-.14	-.12	.48	.43	.09	-.03	.17	.13	.18	.40
bfas_85R	-.29	-.21	.20	.23	.05	-.05	.14	.10	.42	.43
bfas_95	-.20	-.20	.46	.32	.14	.02	.19	.25	.16	.44
bfas_10	-.05	-.05	.15	.06	.40	.30	.06	.05	.16	.27
bfas_20	.06	.04	.15	-.01	.37	.30	-.10	-.13	.25	.46
bfas_30	.05	.00	.23	-.01	.37	.20	.00	-.01	.11	.43
bfas_40	.16	.13	.17	.06	.32	.18	-.07	-.11	.14	.25
bfas_50R	.02	.01	.07	.02	.30	.26	-.06	-.10	.32	.36
bfas_60R	-.05	.01	-.03	.01	.30	.33	-.12	-.08	.41	.36
bfas_70	.13	.10	.16	.05	.27	.21	-.17	-.15	.17	.37
bfas_80R	.02	.06	-.09	-.15	.21	.06	-.14	-.21	.40	.35
bfas_90R	.04	.12	-.10	-.10	.24	.09	-.17	-.25	.35	.31
bfas_100	.07	.01	.19	.09	.41	.34	-.05	-.01	.15	.39

Note. Items were presented in the following row-wise order, with items from each aspect separated by a horizontal line: Withdrawal, Volatility, Compassion, Politeness, Industriousness, Orderliness, Enthusiasm, Assertiveness, Intellect, Openness. nS = non-SAPA development sample; S = SAPA development sample.

Table 8

Pairwise Item Administration Summaries for each Big Five domain in the SAPA Development Sample

Big Five Domain	Mean	SD	Median	Minimum	Maximum
Neuroticism	4,758.47	6,233.76	2,796.00	2,630.00	39,563.00
Agreeableness	5,928.28	6,126.95	4,537.50	2,643.00	42,149.00
Conscientiousness	5,033.17	3,939.93	4,474.00	2,785.00	42,666.00
Extraversion	5,469.56	5,343.94	4,554.00	2,758.00	42,669.00
Openness/Intellect	5,059.53	4,098.97	4,520.00	2,848.00	42,274.00

Table 9

2-factor Solution Pattern Matrix, Neuroticism Aspects

	Item Label	Vol nS	Vol S	With nS	With S
bfas_1R	Seldom feel blue.	.02	.00	.35	.53
bfas_11	Am filled with doubts about things.	-.07	-.06	.74	.75
bfas_21R	Feel comfortable with myself.	-.01	-.05	.58	.69
bfas_31	Feel threatened easily.	.16	.12	.49	.54
bfas_41R	Rarely feel depressed.	.10	-.01	.51	.66
bfas_51	Worry about things.	-.01	.11	.63	.56
bfas_61	Am easily discouraged.	.07	.00	.65	.68
bfas_71R	Am not embarrassed easily.	-.05	.00	.47	.52
bfas_81	Become overwhelmed by events.	.05	.07	.59	.61
bfas_91	Am afraid of many things.	.02	.02	.60	.64
bfas_6	Get angry easily.	.85	.88	-.13	-.14
bfas_16R	Rarely get irritated.	.61	.71	-.01	-.01
bfas_26	Get upset easily.	.70	.65	.11	.21
bfas_36R	Keep my emotions under control.	.46	.48	.14	.17
bfas_46	Change my mood a lot.	.47	.43	.25	.34
bfas_56R	Rarely lose my composure.	.52	.54	-.01	.08
bfas_66	Am a person whose moods go up and down easily.	.50	.43	.30	.42
bfas_76R	Am not easily annoyed.	.60	.71	.02	-.04
bfas_86	Get easily agitated.	.76	.79	.02	.02
bfas_96	Can be stirred up easily.	.67	.69	.01	.06

Note. Congruence coefficients, Volatility factors: 0.992; Withdrawal factors: 0.989. The Withdrawal and Volatility factors were correlated at $r = 0.61$ in the SAPA dataset and $r = 0.68$ in the non-SAPA dataset. Vol = Volatility; With = Withdrawal; nS = non-SAPA development sample; S = SAPA development sample.

Table 10

2-factor Solution Pattern Matrix, Agreeableness Aspects

	Item Label	Comp nS	Comp S	Pol nS	Pol S
bfas_2R	Am not interested in other people's problems.	.51	.64	.09	-.03
bfas_12	Feel others' emotions.	.64	.66	-.09	-.02
bfas_22	Inquire about others' well-being.	.71	.73	-.06	-.06
bfas_32R	Can't be bothered with other's needs.	.47	.66	.26	.09
bfas_42	Sympathize with others' feelings.	.73	.73	.01	.06
bfas_52R	Am indifferent to the feelings of others.	.47	.57	.24	.18
bfas_62R	Take no time for others.	.44	.60	.29	.05
bfas_72	Take an interest in other people's lives.	.73	.76	-.10	-.15
bfas_82R	Don't have a soft side.	.36	.41	.29	.11
bfas_92	Like to do things for others.	.57	.64	.07	.07
bfas_7	Respect authority.	.09	.18	.22	.23
bfas_17R	Believe that I am better than others.	-.01	.17	.51	.38
bfas_27	Hate to seem pushy.	.12	.05	.25	.38
bfas_37R	Take advantage of others.	.04	.17	.65	.56
bfas_47	Avoid imposing my will on others.	-.02	-.07	.28	.52
bfas_57	Rarely put people under pressure.	.02	-.08	.32	.49
bfas_67R	Insult people.	.04	.07	.59	.59
bfas_77R	Seek conflict.	-.05	-.05	.66	.65
bfas_87R	Love a good fight.	-.06	-.07	.60	.54
bfas_97R	Am out for my own personal gain.	.08	.24	.47	.37

Note. Congruence coefficients, Compassion factors: 0.983; Politeness factors: 0.943. The Compassion and Politeness factors were correlated at r = 0.43 in the SAPA dataset and r = 0.47 in the non-SAPA dataset. Comp = Compassion; Pol = Politeness; nS = non-SAPA development sample; S = SAPA development sample.

Table 11

2-factor Solution Pattern Matrix, Conscientiousness Aspects

	Item Label	Ind nS	Ind S	Ord nS	Ord S
bfas_3	Carry out my plans.	.49	.59	.14	.14
bfas_13R	Waste my time.	.71	.69	.01	.00
bfas_23R	Find it difficult to get down to work.	.74	.76	-.03	-.04
bfas_33R	Mess things up.	.60	.61	.00	-.03
bfas_43	Finish what I start.	.52	.63	.20	.13
bfas_53R	Don't put my mind on the task at hand.	.47	.60	.04	.03
bfas_63	Get things done quickly.	.43	.50	.10	.10
bfas_73	Always know what I am doing.	.40	.51	.07	.02
bfas_83R	Postpone decisions.	.59	.66	-.06	-.09
bfas_93R	Am easily distracted.	.69	.62	-.11	-.07
bfas_8R	Leave my belongings around.	.35	.30	.28	.31
bfas_18	Like order.	.00	.01	.63	.75
bfas_28	Keep things tidy.	.24	.27	.52	.53
bfas_38	Follow a schedule.	.27	.32	.45	.44
bfas_48R	Am not bothered by messy people.	.02	.00	.39	.49
bfas_58	Want everything to be "just right."	-.17	-.19	.64	.63
bfas_68R	Am not bothered by disorder.	.03	-.06	.47	.56
bfas_78R	Dislike routine.	.08	.06	.44	.43
bfas_88	See that rules are observed.	.05	.10	.38	.43
bfas_98	Want every detail taken care of.	-.05	.01	.56	.58

Note. Congruence coefficients, Industriousness factors: 0.992; Orderliness factors: 0.994. The Industriousness and Orderliness factors were correlated at r = 0.45 in the SAPA dataset and r = 0.40 in the non-SAPA dataset. Ind = Industriousness; Ord = Orderliness; nS = non-SAPA development sample; S = SAPA development sample.

Table 12

2-factor Solution Pattern Matrix, Extraversion Aspects

	Item Label	Assert nS	Assert S	Enth nS	Enth S
bfas_4	Make friends easily.	.24	.23	.49	.58
bfas_14R	Am hard to get to know.	-.10	-.11	.70	.73
bfas_24R	Keep others at a distance.	-.06	-.08	.65	.71
bfas_34R	Reveal little about myself.	-.10	-.09	.58	.59
bfas_44	Warm up quickly to others.	.08	.05	.55	.66
bfas_54R	Rarely get caught up in the excitement.	-.03	-.03	.45	.50
bfas_64R	Am not a very enthusiastic person.	.12	.21	.53	.48
bfas_74	Show my feelings when I'm happy.	.04	.04	.52	.59
bfas_84	Have a lot of fun.	.17	.18	.51	.52
bfas_94	Laugh a lot.	.04	.09	.55	.52
bfas_9	Take charge.	.78	.79	-.08	-.04
bfas_19	Have a strong personality.	.62	.63	.02	.05
bfas_29R	Lack the talent for influencing people.	.50	.64	.15	.05
bfas_39	Know how to captivate people.	.57	.55	.12	.17
bfas_49R	Wait for others to lead the way.	.61	.73	-.03	-.09
bfas_59	See myself as a good leader.	.71	.75	.04	.03
bfas_69	Can talk others into doing things.	.51	.56	.01	-.01
bfas_79R	Hold back my opinions.	.38	.40	.10	.12
bfas_89	Am the first to act.	.64	.61	-.03	.05
bfas_99R	Do not have an assertive personality.	.54	.58	.03	-.01

Note. Congruence coefficients, Assertiveness factors: 0.995; Enthusiasm factors: 0.993. The Assertiveness and Enthusiasm factors were correlated at r = 0.48 in the SAPA dataset and r = 0.48 in the non-SAPA dataset. Assert = Assertiveness; Enth = Enthusiasm; nS = non-SAPA development sample; S = SAPA development sample.

Table 13

2-factor Solution Pattern Matrix, Openness/Intellect Aspects

	Item Label	Int nS	Int S	Open nS	Open S
bfas_10	Enjoy the beauty of nature.	.09	.03	.46	.42
bfas_20	Believe in the importance of art.	-.02	-.04	.68	.72
bfas_30	Love to reflect on things.	.09	.16	.44	.39
bfas_40	Get deeply immersed in music.	-.02	-.05	.47	.42
bfas_50R	Do not like poetry.	-.05	-.02	.58	.56
bfas_60R	Seldom notice the emotional aspects of paintings and pictures.	-.05	-.03	.55	.57
bfas_70	Need a creative outlet.	-.05	-.03	.53	.55
bfas_80R	Seldom get lost in thought.	.02	.03	.36	.34
bfas_90R	Seldom daydream.	-.04	-.03	.36	.38
bfas_100	See the beauty in things that others might not notice.	.01	.03	.57	.56
bfas_5	Am quick to understand things.	.72	.75	-.05	-.02
bfas_15R	Have difficulty understanding abstract ideas.	.44	.47	.27	.28
bfas_25	Can handle a lot of information.	.70	.72	-.04	-.06
bfas_35	Like to solve complex problems.	.52	.57	.12	.08
bfas_45R	Avoid philosophical discussions.	.21	.26	.40	.38
bfas_55R	Avoid difficult reading material.	.38	.44	.28	.23
bfas_65	Have a rich vocabulary.	.43	.47	.23	.26
bfas_75	Think quickly.	.64	.65	-.05	-.07
bfas_85R	Learn things slowly.	.63	.69	-.08	-.10
bfas_95	Formulate ideas clearly.	.59	.56	.04	.04

Note. Congruence coefficients, Openness factors: 0.997; Intellect factors: 0.997. The Openness and Intellect factors were correlated at r = 0.30 in the SAPA dataset and r = 0.34 in the non-SAPA dataset. Int = Intellect; Open = Openness; nS = non-SAPA development sample; S = SAPA development sample.

Table 14
Fit statistics for ESEM models

	Chi-squared statistic	RMSEA (90% CI)	CFI	TLI	SRMR
non-SAPA Neuroticism	4068.80	.091 (.088, .093)	.93	.91	.034
SAPA Neuroticism	5969.06	.013 (.013, .013)	.99	.98	.043
non-SAPA Agreeableness	1367.59	.050 (.048, .053)	.97	.96	.026
SAPA Agreeableness	3447.87	.010 (.009, .010)	.99	.99	.034
non-SAPA Conscientiousness	2970.20	.077 (.074, .079)	.92	.90	.036
SAPA Conscientiousness	4288.13	.011 (.010, .011)	.98	.97	.038
non-SAPA Extraversion	3187.29	.080 (.077, .082)	.93	.91	.036
SAPA Extraversion	5685.10	.012 (.012, .013)	.98	.97	.043
non-SAPA Openness/Intellect	3366.96	.082 (.080, .085)	.91	.89	.040
SAPA Openness/Intellect	4489.29	.011 (.011, .011)	.97	.97	.049

Note. All chi-squared test statistics were significant at df = 150 ($p < .0001$).

Table 15

Neuroticism Standardized ESEM loadings

	Item Labels	f1 non-SAPA (SE)	f2 non-SAPA (SE)	f1 SAPA (SE)	f2 SAPA (SE)
bfas_1R	Seldom feel blue.	.46 (.02)	-.02 (.02)	.60 (.01)	-.03 (.01)
bfas_11	Am filled with doubts about things.	.75 (.01)	-.06 (.01)	.75 (.01)	-.05 (.01)
bfas_21R	Feel comfortable with myself.	.67 (.02)	-.02 (.02)	.74 (.01)	-.06 (.01)
bfas_31	Feel threatened easily.	.52 (.02)	.16 (.02)	.52 (.01)	.13 (.01)
bfas_41R	Rarely feel depressed.	.63 (.02)	.08 (.02)	.84 (.01)	-.10 (.01)
bfas_51	Worry about things.	.67 (.02)	-.01 (.02)	.51 (.01)	.20 (.01)
bfas_61	Am easily discouraged.	.66 (.02)	.08 (.02)	.68 (.01)	.01 (.02)
bfas_71R	Am not embarrassed easily.	.54 (.02)	-.05 (.02)	.54 (.01)	.02 (.01)
bfas_81	Become overwhelmed by events.	.60 (.02)	.06 (.02)	.58 (.01)	.09 (.02)
bfas_91	Am afraid of many things.	.61 (.02)	.03 (.02)	.65 (.01)	.02 (.02)
bfas_6	Get angry easily.	-.15 (.01)	.89 (.01)	-.10 (.01)	.90 (.01)
bfas_16R	Rarely get irritated.	-.01 (.02)	.68 (.02)	-.02 (.01)	.79 (.01)
bfas_26	Get upset easily.	.10 (.02)	.72 (.01)	.23 (.01)	.62 (.01)
bfas_36R	Keep my emotions under control.	.18 (.02)	.49 (.02)	.20 (.02)	.53 (.01)
bfas_46	Change my mood a lot.	.28 (.02)	.50 (.02)	.47 (.01)	.35 (.01)
bfas_56R	Rarely lose my composure.	.04 (.02)	.55 (.02)	.10 (.02)	.58 (.01)
bfas_66	Am a person whose moods go up and down easily.	.34 (.02)	.53 (.02)	.59 (.01)	.39 (.01)
bfas_76R	Am not easily annoyed.	.02 (.02)	.67 (.02)	-.06 (.01)	.79 (.01)
bfas_86	Get easily agitated.	.02 (.02)	.77 (.01)	.03 (.01)	.80 (.01)
bfas_96	Can be stirred up easily.	.01 (.02)	.68 (.02)	.08 (.01)	.68 (.01)

Note. Withdrawal items are presented in the top half of the table; Volatility items are presented in the bottom half. In the non-SAPA sample, the factors were correlated at r = .67 and the standardized absolute magnitude of loadings on the acquiescence factor was .22; in the SAPA sample, the factors were correlated at r = .58 and standardized absolute acquiescence factor loadings were .19.

Table 16

Agreeableness Standardized ESEM loadings

	Item Labels	f1 non-SAPA (SE)	f2 non-SAPA (SE)	f1 SAPA (SE)	f2 SAPA (SE)
bfas_2R	Am not interested in other people's problems.	.69 (.02)	-.08 (.02)	.72 (.01)	-.11 (.01)
bfas_12	Feel others' emotions.	.68 (.02)	-.06 (.02)	.73 (.01)	.02 (.01)
bfas_22	Inquire about others' well-being.	.75 (.01)	-.04 (.02)	.73 (.01)	-.01 (.01)
bfas_32R	Can't be bothered with other's needs.	.64 (.02)	.10 (.02)	.73 (.01)	.06 (.01)
bfas_42	Sympathize with others' feelings.	.76 (.01)	.03 (.02)	.78 (.00)	.10 (.01)
bfas_52R	Am indifferent to the feelings of others.	.64 (.02)	.08 (.02)	.62 (.01)	.15 (.01)
bfas_62R	Take no time for others.	.63 (.02)	.13 (.02)	.66 (.01)	.05 (.01)
bfas_72	Take an interest in other people's lives.	.78 (.01)	-.10 (.02)	.82 (.01)	-.18 (.01)
bfas_82R	Don't have a soft side.	.53 (.02)	.17 (.02)	.50 (.01)	.12 (.01)
bfas_92	Like to do things for others.	.59 (.02)	.11 (.02)	.65 (.01)	.11 (.01)
bfas_7	Respect authority.	.05 (.02)	.32 (.02)	.19 (.01)	.27 (.01)
bfas_17R	Believe that I am better than others.	.04 (.02)	.48 (.02)	.19 (.01)	.39 (.01)
bfas_27	Hate to seem pushy.	.05 (.02)	.43 (.02)	.03 (.01)	.48 (.01)
bfas_37R	Take advantage of others.	.12 (.02)	.63 (.02)	.20 (.01)	.58 (.02)
bfas_47	Avoid imposing my will on others.	-.16 (.02)	.50 (.02)	-.10 (.01)	.61 (.01)
bfas_57	Rarely put people under pressure.	-.09 (.02)	.53 (.02)	-.11 (.01)	.57 (.01)
bfas_67R	Insult people.	.09 (.02)	.58 (.02)	.13 (.01)	.57 (.01)
bfas_77R	Seek conflict.	.00 (.02)	.69 (.02)	-.02 (.01)	.69 (.01)
bfas_87R	Love a good fight.	-.02 (.02)	.61 (.02)	-.04 (.01)	.54 (.02)
bfas_97R	Am out for my own personal gain.	.15 (.02)	.41 (.02)	.26 (.01)	.38 (.01)

Note. Compassion items are presented in the top half of the table; Politeness items are presented in the bottom half. In the non-SAPA sample, the factors were correlated at r = .54 and the standardized absolute magnitude of loadings on the acquiescence factor was .21; in the SAPA sample, the factors were correlated at r = .43 and standardized absolute acquiescence factor loadings were .17.

Table 17

Conscientiousness Standardized ESEM loadings

	Item Labels	f1 non-SAPA (SE)	f2 non-SAPA (SE)	f1 SAPA (SE)	f2 SAPA (SE)
bfas_3	Carry out my plans.	.63 (.02)	.05 (.02)	.70 (.01)	.08 (.01)
bfas_13R	Waste my time.	.73 (.01)	.01 (.01)	.74 (.01)	-.01 (.01)
bfas_23R	Find it difficult to get down to work.	.77 (.01)	-.03 (.01)	.80 (.01)	-.06 (.01)
bfas_33R	Mess things up.	.60 (.02)	.03 (.02)	.60 (.01)	-.01 (.01)
bfas_43	Finish what I start.	.67 (.01)	.09 (.02)	.72 (.01)	.08 (.01)
bfas_53R	Don't put my mind on the task at hand.	.49 (.02)	.07 (.02)	.61 (.01)	.06 (.01)
bfas_63	Get things done quickly.	.55 (.02)	.01 (.02)	.55 (.01)	.06 (.01)
bfas_73	Always know what I am doing.	.51 (.02)	-.04 (.02)	.54 (.01)	-.01 (.01)
bfas_83R	Postpone decisions.	.61 (.02)	-.06 (.02)	.67 (.01)	-.07 (.01)
bfas_93R	Am easily distracted.	.70 (.01)	-.10 (.01)	.62 (.01)	-.06 (.01)
bfas_8R	Leave my belongings around.	.32 (.02)	.38 (.02)	.29 (.01)	.39 (.01)
bfas_18	Like order.	.06 (.02)	.62 (.02)	.07 (.01)	.74 (.01)
bfas_28	Keep things tidy.	.28 (.02)	.53 (.02)	.30 (.01)	.56 (.01)
bfas_38	Follow a schedule.	.36 (.02)	.39 (.02)	.38 (.01)	.41 (.01)
bfas_48R	Am not bothered by messy people.	-.11 (.02)	.61 (.02)	-.04 (.01)	.60 (.01)
bfas_58	Want everything to be "just right."	-.11 (.02)	.62 (.02)	-.18 (.01)	.68 (.01)
bfas_68R	Am not bothered by disorder.	-.08 (.01)	.68 (.01)	-.11 (.01)	.67 (.01)
bfas_78R	Dislike routine.	.08 (.02)	.53 (.02)	.07 (.01)	.50 (.01)
bfas_88	See that rules are observed.	.12 (.02)	.33 (.02)	.15 (.01)	.41 (.01)
bfas_98	Want every detail taken care of.	.01 (.02)	.54 (.02)	.01 (.01)	.62 (.01)

Note. Industriousness items are presented in the top half of the table; Orderliness items are presented in the bottom half. In the non-SAPA sample, the factors were correlated at r = .43 and the standardized absolute magnitude of loadings on the acquiescence factor was .21; in the SAPA sample, the factors were correlated at r = .45 and standardized absolute acquiescence factor loadings were .17.

Table 18

Extraversion Standardized ESEM loadings

	Item Labels	f1 non-SAPA (SE)	f2 non-SAPA (SE)	f1 SAPA (SE)	f2 SAPA (SE)
bfas_4	Make friends easily.	.56 (.02)	.20 (.02)	.64 (.01)	.20 (.01)
bfas_14R	Am hard to get to know.	.74 (.01)	-.09 (.01)	.77 (.01)	-.10 (.01)
bfas_24R	Keep others at a distance.	.68 (.01)	-.05 (.01)	.76 (.01)	-.10 (.01)
bfas_34R	Reveal little about myself.	.62 (.02)	-.10 (.02)	.66 (.01)	-.11 (.01)
bfas_44	Warm up quickly to others.	.63 (.02)	.04 (.02)	.69 (.01)	.04 (.01)
bfas_54R	Rarely get caught up in the excitement.	.47 (.02)	.02 (.02)	.51 (.01)	-.02 (.01)
bfas_64R	Am not a very enthusiastic person.	.55 (.02)	.18 (.02)	.51 (.01)	.23 (.01)
bfas_74	Show my feelings when I'm happy.	.62 (.02)	.01 (.02)	.62 (.01)	.05 (.01)
bfas_84	Have a lot of fun.	.61 (.02)	.13 (.02)	.61 (.01)	.15 (.01)
bfas_94	Laugh a lot.	.67 (.02)	-.01 (.02)	.62 (.01)	.06 (.01)
bfas_9	Take charge.	-.08 (.01)	.81 (.01)	-.08 (.01)	.85 (.00)
bfas_19	Have a strong personality.	.04 (.02)	.63 (.01)	.11 (.01)	.62 (.01)
bfas_29R	Lack the talent for influencing people.	.13 (.02)	.60 (.02)	.11 (.01)	.66 (.01)
bfas_39	Know how to captivate people.	.16 (.02)	.56 (.02)	.28 (.01)	.47 (.00)
bfas_49R	Wait for others to lead the way.	-.08 (.01)	.73 (.01)	-.09 (.01)	.80 (.01)
bfas_59	See myself as a good leader.	.07 (.01)	.71 (.01)	.04 (.01)	.79 (.01)
bfas_69	Can talk others into doing things.	.04 (.02)	.51 (.02)	.04 (.01)	.57 (.01)
bfas_79R	Hold back my opinions.	.07 (.02)	.46 (.02)	.13 (.01)	.44 (.01)
bfas_89	Am the first to act.	-.01 (.02)	.64 (.01)	.05 (.01)	.63 (.01)
bfas_99R	Do not have an assertive personality.	-.01 (.02)	.63 (.02)	.00 (.01)	.62 (.01)

Note. Enthusiasm items are presented in the top half of the table; Assertiveness items are presented in the bottom half. In the non-SAPA sample, the factors were correlated at r = .49 and the standardized absolute magnitude of loadings on the acquiescence factor was .21; in the SAPA sample, the factors were correlated at r = .46 and standardized absolute acquiescence factor loadings were .15.

Table 19

Openness/Intellect Standardized ESEM loadings

	Item Labels	f1 non-SAPA (SE)	f2 non-SAPA (SE)	f1 SAPA (SE)	f2 SAPA (SE)
bfas_5	Am quick to understand things.	.77 (.01)	-.06 (.01)	.81 (.01)	-.05 (.01)
bfas_15R	Have difficulty understanding abstract ideas.	.53 (.02)	.28 (.02)	.52 (.01)	.31 (.01)
bfas_25	Can handle a lot of information.	.73 (.01)	-.04 (.01)	.73 (.01)	-.03 (.01)
bfas_35	Like to solve complex problems.	.54 (.01)	.12 (.02)	.58 (.01)	.13 (.01)
bfas_45R	Avoid philosophical discussions.	.27 (.02)	.42 (.02)	.32 (.01)	.44 (.01)
bfas_55R	Avoid difficult reading material.	.47 (.02)	.29 (.02)	.49 (.01)	.31 (.01)
bfas_65	Have a rich vocabulary.	.45 (.02)	.24 (.02)	.48 (.01)	.33 (.01)
bfas_75	Think quickly.	.68 (.01)	-.05 (.01)	.69 (.01)	-.07 (.01)
bfas_85R	Learn things slowly.	.75 (.01)	-.11 (.01)	.81 (.01)	-.13 (.01)
bfas_95	Formulate ideas clearly.	.62 (.01)	.04 (.02)	.59 (.01)	.06 (.01)
bfas_10	Enjoy the beauty of nature.	.10 (.02)	.53 (.02)	.04 (.01)	.48 (.01)
bfas_20	Believe in the importance of art.	-.02 (.01)	.74 (.01)	-.03 (.01)	.76 (.01)
bfas_30	Love to reflect on things.	.10 (.02)	.48 (.02)	.17 (.01)	.45 (.01)
bfas_40	Get deeply immersed in music.	-.03 (.02)	.53 (.02)	-.05 (.01)	.45 (.01)
bfas_50R	Do not like poetry.	.00 (.02)	.60 (.01)	.01 (.01)	.58 (.01)
bfas_60R	Seldom notice the emotional aspects of paintings and pictures.	.00 (.02)	.59 (.01)	.00 (.01)	.60 (.01)
bfas_70	Need a creative outlet.	-.07 (.02)	.58 (.01)	-.02 (.01)	.57 (.01)
bfas_80R	Seldom get lost in thought.	-.03 (.02)	.54 (.02)	-.06 (.01)	.61 (.01)
bfas_90R	Seldom daydream.	-.10 (.02)	.54 (.02)	-.12 (.01)	.64 (.01)
bfas_100	See the beauty in things that others might not notice.	.01 (.02)	.62 (.01)	.05 (.01)	.59 (.01)

Note. Intellect items are presented in the top half of the table; Openness items are presented in the bottom half. In the non-SAPA sample, the factors were correlated at r = .36 and the standardized absolute magnitude of loadings on the acquiescence factor was .21; in the SAPA sample, the factors were correlated at r = .29 and standardized absolute acquiescence factor loadings were .16.

Table 20

The BFAS short form with balanced keying (BFAS-SB)

variable	scale	subscale	label
bfas_32R	Agreeableness	Compassion	Can't be bothered with other's needs.
bfas_62R	Agreeableness	Compassion	Take no time for others.
bfas_22	Agreeableness	Compassion	Inquire about others' well-being.
bfas_42	Agreeableness	Compassion	Sympathize with others' feelings.
bfas_37R	Agreeableness	Politeness	Take advantage of others.
bfas_77R	Agreeableness	Politeness	Seek conflict.
bfas_47	Agreeableness	Politeness	Avoid imposing my will on others.
bfas_57	Agreeableness	Politeness	Rarely put people under pressure.
bfas_23R	Conscientiousness	Industriousness	Find it difficult to get down to work.
bfas_93R	Conscientiousness	Industriousness	Am easily distracted.
bfas_43	Conscientiousness	Industriousness	Finish what I start.
bfas_63	Conscientiousness	Industriousness	Get things done quickly.
bfas_48R	Conscientiousness	Orderliness	Am not bothered by messy people.
bfas_78R	Conscientiousness	Orderliness	Dislike routine.
bfas_18	Conscientiousness	Orderliness	Like order.
bfas_58	Conscientiousness	Orderliness	Want everything to be "just right."
bfas_49R	Extraversion	Assertiveness	Wait for others to lead the way.
bfas_99R	Extraversion	Assertiveness	Do not have an assertive personality.
bfas_9	Extraversion	Assertiveness	Take charge.
bfas_69	Extraversion	Assertiveness	Can talk others into doing things.
bfas_14R	Extraversion	Enthusiasm	Am hard to get to know.
bfas_54R	Extraversion	Enthusiasm	Rarely get caught up in the excitement.
bfas_44	Extraversion	Enthusiasm	Warm up quickly to others.
bfas_94	Extraversion	Enthusiasm	Laugh a lot.
bfas_16R	Neuroticism	Volatility	Rarely get irritated.
bfas_36R	Neuroticism	Volatility	Keep my emotions under control.
bfas_6	Neuroticism	Volatility	Get angry easily.
bfas_86	Neuroticism	Volatility	Get easily agitated.
bfas_21R	Neuroticism	Withdrawal	Feel comfortable with myself.
bfas_41R	Neuroticism	Withdrawal	Rarely feel depressed.
bfas_11	Neuroticism	Withdrawal	Am filled with doubts about things.
bfas_51	Neuroticism	Withdrawal	Worry about things.
bfas_55R	Openness/Intellect	Intellect	Avoid difficult reading material.
bfas_85R	Openness/Intellect	Intellect	Learn things slowly.
bfas_25	Openness/Intellect	Intellect	Can handle a lot of information.
bfas_35	Openness/Intellect	Intellect	Like to solve complex problems.
bfas_60R	Openness/Intellect	Openness Aspect	Rarely notice the emotional aspects of paintings and pictures.*
bfas_90R	Openness/Intellect	Openness Aspect	Rarely daydream.*
bfas_20	Openness/Intellect	Openness Aspect	Believe in the importance of art.
bfas_70	Openness/Intellect	Openness Aspect	Need a creative outlet.

Note. *These items now begin with 'Rarely' instead of 'Seldom'. Variables ending with R are reverse-keyed.

Table 21

Item Properties of the BFAS-SB

variable	subscale	label	Mean	SD	Skew	Kurtosis	BFAS-40
bfas_32R	Compassion	Can't be bothered with other's needs.	3.64	1.12	-0.70	-0.33	Yes
bfas_62R	Compassion	Take no time for others.	3.80	1.11	-0.95	0.16	No
bfas_22	Compassion	Inquire about others' well-being.	4.04	0.83	-1.01	1.41	Yes
bfas_42	Compassion	Sympathize with others' feelings.	4.11	0.84	-1.20	1.88	No
bfas_37R	Politeness	Take advantage of others.	3.80	1.19	-0.90	-0.13	No
bfas_77R	Politeness	Seek conflict.	3.89	1.24	-0.99	-0.10	Yes
bfas_47	Politeness	Avoid imposing my will on others.	3.50	0.97	-0.49	-0.28	No
bfas_57	Politeness	Rarely put people under pressure.	3.59	0.96	-0.64	-0.07	Yes
bfas_23R	Industriousness	Find it difficult to get down to work.	3.12	1.15	-0.13	-1.00	Yes
bfas_93R	Industriousness	Am easily distracted.	2.66	1.14	0.34	-0.87	Yes
bfas_43	Industriousness	Finish what I start.	3.88	0.88	-0.79	0.53	No
bfas_63	Industriousness	Get things done quickly.	3.51	0.96	-0.48	-0.35	No
bfas_48R	Orderliness	Am not bothered by messy people.	3.36	1.16	-0.30	-0.96	No
bfas_78R	Orderliness	Dislike routine.	3.62	1.16	-0.65	-0.48	No
bfas_18	Orderliness	Like order.	3.91	0.89	-0.82	0.64	Yes
bfas_58	Orderliness	Want everything to be "just right."	3.67	1.10	-0.73	-0.24	No
bfas_49R	Assertiveness	Wait for others to lead the way.	3.06	1.07	0.02	-0.82	Yes
bfas_99R	Assertiveness	Do not have an assertive personality.	3.05	1.15	-0.07	-0.96	No
bfas_9	Assertiveness	Take charge.	3.49	1.03	-0.47	-0.46	Yes
bfas_69	Assertiveness	Can talk others into doing things.	3.38	0.99	-0.50	-0.40	No
bfas_14R	Enthusiasm	Am hard to get to know.	3.06	1.20	-0.10	-1.06	No
bfas_54R	Enthusiasm	Rarely get caught up in the excitement.	3.44	1.05	-0.54	-0.45	No
bfas_44	Enthusiasm	Warm up quickly to others.	3.44	1.05	-0.42	-0.63	Yes
bfas_94	Enthusiasm	Laugh a lot.	4.03	0.95	-0.99	0.70	No
bfas_16R	Volatility	Rarely get irritated.	3.14	1.11	-0.21	-0.92	No
bfas_36R	Volatility	Keep my emotions under control.	2.43	1.00	0.62	-0.22	No
bfas_6	Volatility	Get angry easily.	2.53	1.14	0.40	-0.79	Yes
bfas_86	Volatility	Get easily agitated.	2.75	1.12	0.19	-0.98	Yes
bfas_21R	Withdrawal	Feel comfortable with myself.	2.31	1.02	0.76	0.03	No
bfas_41R	Withdrawal	Rarely feel depressed.	3.16	1.23	-0.15	-1.08	Yes
bfas_11	Withdrawal	Am filled with doubts about things.	3.46	1.13	-0.48	-0.66	No
bfas_51	Withdrawal	Worry about things.	3.98	1.01	-1.12	0.90	Yes
bfas_55R	Intellect	Avoid difficult reading material.	3.27	1.19	-0.26	-1.01	Yes
bfas_85R	Intellect	Learn things slowly.	3.38	1.05	-0.44	-0.61	No
bfas_25	Intellect	Can handle a lot of information.	3.78	0.91	-0.79	0.42	Yes
bfas_35	Intellect	Like to solve complex problems.	3.52	1.04	-0.55	-0.40	No
bfas_60R	Openness Aspect	Rarely notice the emotional aspects of paintings and pictures.*	3.34	1.14	-0.36	-0.78	Yes
bfas_90R	Openness Aspect	Rarely daydream.*	3.52	1.15	-0.54	-0.66	Yes
bfas_20	Openness Aspect	Believe in the importance of art.	3.83	1.05	-0.78	0.00	Yes
bfas_70	Openness Aspect	Need a creative outlet.	3.56	1.09	-0.45	-0.63	No

Note. *These items now begin with 'Rarely' instead of 'Seldom'. Variables ending with R were reverse-keyed. BFAS-40: whether the item was part of the BFAS-40 (Gallagher et al., 2022).

Table 22

BFAS-SB Scale Properties

scale	Mean	SD	Skew	Kurtosis	Part-Whole r	Avg item r	Omega h	u	Alpha	Omega t	ICC
Neuroticism	2.99	.71	-.01	-.20	.94	.32	.56	.86	.79	.82	.81
Withdrawal	3.29	.84	-.15	-.26	.87	.38	.54	.94	.71	.76	.76
Volatility	2.71	.83	.19	-.44	.93	.42	.67	.95	.75	.77	.80
Agreeableness	3.82	.62	-.38	-.41	.94	.23	.36	.49	.72	.78	.78
Compassion	3.90	.70	-.50	.06	.93	.35	.48	.73	.68	.78	.69
Politeness	3.74	.74	-.43	-.26	.88	.21	.21	.44	.53	.67	.76
Conscientiousness	3.47	.57	-.01	-.01	.90	.19	.22	.54	.64	.70	.78
Industriousness	3.28	.76	-.07	-.25	.91	.36	.60	.92	.69	.74	.77
Orderliness	3.64	.70	-.18	-.34	.85	.22	.34	.84	.53	.60	.77
Extraversion	3.37	.61	-.19	.05	.93	.22	.42	.65	.69	.74	.82
Enthusiasm	3.51	.74	-.23	-.23	.90	.28	.35	.91	.60	.70	.78
Assertiveness	3.24	.78	-.17	-.25	.92	.35	.52	.89	.69	.73	.83
Openness/Intellect	3.53	.57	.02	-.22	.92	.17	.26	.43	.63	.69	.83
Intellect	3.49	.73	-.21	-.18	.90	.30	.37	.93	.63	.74	.79
Openness Aspect	3.57	.75	-.17	-.39	.90	.29	.45	.85	.61	.68	.84

Note. Avg item r = Average interitem correlation. Omega h = Omega hierarchical, 2 group factors. Omega t = Omega total, 2 group factors. u = Revelle's unidimensionality measure. ICC = Intraclass correlations (ICC 3,1) across four waves of longitudinal data, N = 150.

Table 23

Five-factor solution in the BFAS-SB

	Subscale	Item Label	f1	f2	f3	f4	f5
bfas_32R	Compassion	Can't be bothered with other's needs.	.00	.70	.04	.12	.12
bfas_62R	Compassion	Take no time for others.	-.01	.74	.07	.14	.07
bfas_22	Compassion	Inquire about others' well-being.	-.07	.20	.09	.54	.06
bfas_42	Compassion	Sympathize with others' feelings.	-.03	.24	-.04	.50	.13
bfas_37R	Politeness	Take advantage of others.	-.07	.74	-.04	-.01	.02
bfas_77R	Politeness	Seek conflict.	-.08	.74	-.11	-.03	.01
bfas_47	Politeness	Avoid imposing my will on others.	-.14	.04	-.40	.17	-.04
bfas_57	Politeness	Rarely put people under pressure.	-.18	.09	-.36	.17	-.04
bfas_23R	Industriousness	Find it difficult to get down to work.	-.39	.15	.41	-.12	-.16
bfas_93R	Industriousness	Am easily distracted.	-.45	.06	.33	-.21	-.12
bfas_43	Industriousness	Finish what I start.	-.28	.12	.30	.18	-.35
bfas_63	Industriousness	Get things done quickly.	-.23	.00	.29	.15	-.32
bfas_48R	Orderliness	Am not bothered by messy people.	.11	.18	.20	-.15	-.06
bfas_78R	Orderliness	Dislike routine.	.02	.58	.11	-.11	-.18
bfas_18	Orderliness	Like order.	.04	.12	.13	.08	-.29
bfas_58	Orderliness	Want everything to be "just right."	.22	.39	-.02	.11	-.27
bfas_49R	Assertiveness	Wait for others to lead the way.	-.12	.05	.67	.03	.08
bfas_99R	Assertiveness	Do not have an assertive personality.	.05	-.02	.60	.03	.05
bfas_9	Assertiveness	Take charge.	.00	-.11	.60	.29	-.14
bfas_69	Assertiveness	Can talk others into doing things.	.03	-.09	.29	.31	-.13
bfas_14R	Enthusiasm	Am hard to get to know.	-.17	.15	.24	.16	.06
bfas_54R	Enthusiasm	Rarely get caught up in the excitement.	.03	.21	.20	.17	.24
bfas_44	Enthusiasm	Warm up quickly to others.	-.15	.00	.15	.44	-.07
bfas_94	Enthusiasm	Laugh a lot.	-.08	.08	.15	.45	-.04
bfas_16R	Volatility	Rarely get irritated.	.59	.11	.16	-.18	.09
bfas_36R	Volatility	Keep my emotions under control.	.52	.06	.00	-.12	.24
bfas_6	Volatility	Get angry easily.	.66	-.15	.05	-.04	-.15
bfas_86	Volatility	Get easily agitated.	.70	-.13	-.04	-.04	-.14
bfas_21R	Withdrawal	Feel comfortable with myself.	.41	.03	-.29	-.29	.23
bfas_41R	Withdrawal	Rarely feel depressed.	.48	.11	-.10	-.12	.34
bfas_11	Withdrawal	Am filled with doubts about things.	.53	-.02	-.33	.09	.08
bfas_51	Withdrawal	Worry about things.	.46	.13	-.21	.18	.03
bfas_55R	Intellect	Avoid difficult reading material.	-.23	.14	.36	-.01	.32
bfas_85R	Intellect	Learn things slowly.	-.27	.10	.39	-.03	.10
bfas_25	Intellect	Can handle a lot of information.	-.21	.01	.33	.25	-.13
bfas_35	Intellect	Like to solve complex problems.	-.15	-.04	.29	.22	-.01
bfas_60R	Openness Aspect	Rarely notice the emotional aspects of paintings and pictures.*	-.08	.14	.10	.16	.54
bfas_90R	Openness Aspect	Rarely daydream.*	.12	.18	-.01	.07	.42
bfas_20	Openness Aspect	Believe in the importance of art.	-.02	.01	.01	.36	.34
bfas_70	Openness Aspect	Need a creative outlet.	.02	-.01	-.01	.36	.29

Note. Principle-axis factoring with varimax rotation. *These items now begin with 'Rarely' instead of 'Seldom'. Variables ending with R are reverse-keyed.

Table 24

Correlation Matrix between short version(s) of the BFAS and the full scale in the Validation sample

	Nw	Nv	Ac	Ap	Ci	Co	Ee	Ea	Oi	Oo
short form Nw	.87	.53	.13	.11	-.45	.07	-.25	-.34	-.28	.15
short form Nv	.53	.93	-.18	-.35	-.32	.03	-.22	-.04	-.23	-.07
short form Ac	.02	-.08	.77	.34	.06	.12	.39	.14	.19	.33
short form Ap	.04	-.17	.28	.66	.05	.05	.08	-.17	.00	.13
short form Ci	-.49	-.36	.09	.12	.91	.36	.19	.28	.38	-.08
short form Co	.09	.10	.13	.12	.21	.76	.06	.10	.09	-.05
short form Ee	-.23	-.15	.42	.15	.15	.04	.90	.38	.21	.11
short form Ea	-.36	-.06	.10	-.26	.33	.11	.36	.92	.47	.10
short form Oi	-.33	-.25	.20	.03	.42	.11	.16	.39	.90	.28
short form Oo	.12	.02	.32	.13	-.12	-.08	.11	.06	.24	.90

Note. Values below the diagonal are correlations between the BFAS-SB and the full BFAS. Values on the diagonal are part-whole correlations between the BFAS-SB and the full BFAS. Values above the diagonal are correlations between the BFAS-40 and the full BFAS.