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Looking for a Simple Big Five Factorial Structure in the Domain of Adjectives*

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Summary: The Big Five factors structure is currently the benchmark for personality dimensions. In the domain of adjectives, various instruments have been developed to measure the Big Five. In this contribution we propose a methodology to find a simple factorial structure and we apply this methodology to the domain of Big Five as measured by adjectives. Using data collected on a sample of 337 subjects, we propose a five-factor benchmark structure derived from the 50 best marker adjectives selected among the adjectives contained in three instruments specifically developed to measure the Big Five (i. e., Goldberg's 100 adjectives list, IASR-B5, and SACBIF). We use this common factor structure (or benchmark structure) to investigate the differences and the similarities between the three operationalizations of the Big Five, and to investigate the placements of the full set of adjectives contained in the three instruments. The main features of the proposed methodology and the generalizability of the obtained results are discussed.

In the last two decades in personality research the factorial (e. g., McCrae & Costa, 1995) and the psycholexical tradition (e. g., Goldberg, 1993) have converged toward a general factorial structure of personality, the so-called Big Five personality factors. The increasing number of articles referring to this five-factor structure provides evidence of agreement in the field of personality structure (for comprehensive reviews, see, e. g., Digman, 1990; McCrae & John, 1992; Wiggins & Pincus, 1992), although some important researchers maintain a different view (e. g., Block, 1995; Eysenck, 1992). The factorial and psycholexical traditions place differential emphasis on theoretical aspects (cf. Goldberg, 1993; Ostendorf & Angleitner, 1994), and they differ with regard to the basic material. Whereas researchers in the factorial tradition typically use sentences to form questionnaires, researchers in the psycholexical tradition typically use adjectives for data collection. (An interesting recent example of developing an items questionnaire starting from a psycholexical approach is given by Hendriks, Hofstee and De Raad, 1999, with the FFPI.) In the psycholexical tradition, some adjective lists have been proposed for measuring the Big Five. Among these, the most well-known are the 100 adjectives list of Goldberg (1992) and the Big Five Interpersonal Adjectives Scale (IAS-B5) of Trapnell and Wiggins (1990). In the Italian context, a well-known list is the SACBIF of Perugini and Leone (1996). All these three instruments perform quite well in their respective countries and capture the Big Five fairly well.

One question arising concerns how much the Big Five structure, as represented by adjectives, is generalizable across cultures. Starting from the original psycholexical studies performed in different countries, cross-cultural generalizability of the Big Five factors has recently been addressed (De Raad, Perugini, & Szirmak, 1997; De Raad, Perugini, Hrebickova, & Szarota, 1997; Hofstee, Kiers, De Raad, Goldberg, & Ostendorf, 1997). Results gave weak support for the idea that the same specific five factors emerge in different cultures. In particular, whereas

* The original data upon which this paper is based are available at http://www.hhpub.com/journals/ejpa

the first four factors were substantially recovered in the different languages, the fifth factor tended to emerge with somewhat different meanings in some of the cultures.

While it may be problematic to find exactly the same five-factor structure *among* different countries, it is possible to find a "good" five-factor structure *within* each culture. The question thus becomes: What is meant by *good* factorial structure? As argued by Goldberg (1992), the development of a set of markers for the Big Five is like the construction of a window: "The fundamental problems are: i) locating the center of the window and ii) establishing its width" (Goldberg, 1992, p. 28). However, the location of the five factors may vary, depending on the original pool of adjectives. In this respect, Goldberg claims that ". . . this situation is similar to that faced by early cartographers as they struggled to provide maps of the emerging world. [. . .] Just as cartographers eventually settled on a standard system with North-South and East-West axes, so personality researchers must settle on a standard set of locations for the Big Five" (1992, p. 14).

Indeed, cartographers settled on a bi-dimensional system with longitude and latitude coordinates that effectively cover any possible point on the planet. The bi-dimensional system is quite simple and fixed, whereas the covered points may be complex (e. g., with different values of latitude and longitude) and may vary (e. g., a new island may be discovered or may disappear). The Big Five factorial model may currently be regarded as the best candidate to represent the coordinates system of personality structure.

This analogy allows us to stress two important properties of the relation between the structure of a phenomenon and its representation:

- The reference structure should not depend on every accidental characteristic of the phenomenon, in the same way as we do not change our geographical coordinates when we discover an unknown island.
- The complexity of the representation does not depend on the complexity of the structure, in the same way as we use simple geographical coordinates when representing millions of islands or just two broad mainlands.

The implication of these two points is that a simple structure is a *sine qua non* for building up a map of personality. The fact that we may miss important features if we establish a narrow width for each factor is irrelevant in the process of building a good personality structure as there are two distinct points: (a) the building of a simple structure; (b) the representation of a complex phenomenon. After having built a good simple structure, we can use the structure to gain information about all the relevant features of personality characteristics, and the analogy with the work of cartographers again holds quite well.

To sum up, we argue that the complexity of a phenomenon should emerge in an adequate representation and not in a complex structure. On the contrary, we believe that the best way to capture a complex phenomenon is to base its complex representation on the simplest possible structure. We therefore follow a logic similar to that behind the construction of the AB5C model (cf. Hofstee, De Raad, & Goldberg, 1992). However, we focus on the first step and propose a specific methodology to deal optimally with the building of a simple factorial structure.

Methodology for Building a Simple Factorial Structure

The following description refers to a set of adjectives used to measure the Big Five. However, the same logic can easily be applied to different settings. For the sake of simplicity, we focus on this specific application, though we maintain the generality of our approach.

Suppose we have a selected pool of adjectives aimed at measuring the Big Five. This may be a set of adjectives contained in well-known instruments for measuring the five factors. To obtain a simple factorial structure, we use the following logic: We locate the factor on the basis of an overall factor analysis on the whole set of adjectives. This guarantees that the factors emerge from a good and exhaustive representative set of adjectives. Once we have located the factors, we select a reduced set of adjectives in order to maximize the simplicity of the resulting factorial structure. That is, all the adjectives of one factor should correlate highly with that factor and should not correlate with the other factors. In this way, we address the problem stated by Goldberg in locating the center of the factor *windows*, selecting subsets of adjectives such that they best represent each factor, being at the same time as simple as possible in terms of the orthogonality of the resulting factorial solution. In particular, we propose a procedure that leads from the whole set of adjectives to a benchmark simple factorial structure.

The first step is to perform a principal component analysis on the whole set of adjectives, extracting five factors with orthogonal (Varimax) rotation. Adjectives not well represented by the extracted factorial structure (i. e., with a primary loading $< |.30|$) are consequently excluded.

The second step concerns the selection of the best markers for each pole of each factor. Among the selected adjectives, we further select the most prototypical adjectives of the five factors, with a balanced number of adjectives for each pole of each factor. For instance, one may decide to select the five best adjectives. As noted by Goldberg (1992), the larger the number of adjectives to be selected, the higher the reliability of the factor. However, if the number is too large, the simplicity and the prototypicity of the factor may suffer. The number chosen in this study (ten adjectives for each factor) represents one possible choice, but different contexts may suggest different solutions.

To select the best markers we used the Marker Index (MI) (Gallucci & Perugini, 1998):

$$\mathrm{MI} = 1 - \sqrt{(1-l_k)^2 + \sum_{i=1}^{k} l_i^2}\ ,\ i \neq k$$

The index varies between 0 and 1, with higher values indicating better markers. (Occasionally values can be negative, up to a minimum of –0.41. However, this happens only with very low primary loadings and with very high remaining loadings. In practice, negative values can be present only in conditions which already imply that the variable would not be selected.) Gallucci and Perugini (1998) showed with a simulation study that the Marker Index is superior to competitor criteria. In their study, the Marker Index was tested along with five alternative criteria, outperforming all of them: the primary loading, the angular distance, the Index of Factorial Simplicity (Kaiser, 1974), factor weights, and Varimax-rotated factor weights. (Gallucci & Perugini, 1998, also showed that the angular distance is formally equivalent, in terms of ranking, to a criterion proposed by Furntratt, 1969, and, in a slightly different form, by Perugini & Leone, 1996.) The next section presents a brief logical argument for the advantage of this index over loading-based alternatives, considering for simplicity a bi-dimensional space. A more detailed presentation can be found in Gallucci and Perugini (1998).

Finally, the third step is to perform again a principal component analysis with Varimax rotation on the selected adjectives. The extracted solution will be the benchmark simple factorial structure.

The Marker Index

In this section we illustrate some logical properties of the Marker Index, as compared with loadings-based alternative criteria for selecting marker variables, in the framework of Principal Component Analysis (PCA). The Marker Index combines primary and secondary loadings in order to obtain markers that improve the simplicity and representative power of the factorial solution.

Consider the N-dimensional factorial solution $S^N \subset \Re^N$, where N is the number of items, and the corresponding solution $S^K \subset \Re^K$, $K < N$, obtained by selecting the K^{th} factors with the highest eigenvalues. If we focus on the full-dimensional solution S^N, the best markers would be selected using primary loadings. Since the communality is fixed at 1, the only free information available is provided by primary loadings. In fact, no matter what the remaining loadings are, their sum of squares must be equal to the difference between 1 and the squared primary loadings. That is, the primary loadings and the sum of the remaining loadings give the same information.

However, the focus is always restricted to S^K, often after an orthogonal rotation has been performed to simplify the factorial structure. The reduced instead of the full factorial space is preferred for three reasons:

- The traits have a higher level of abstraction than the variables (i. e., a single trait influences more observed variables);
- There is no theoretical usefulness in having as many traits as variables;
- A considerable part of the variance of a trait variable is noise rather than reliable specific variance.

In the reduced factorial space, the communality is lower than 1, and thus the primary loading and the sum of the remaining loadings no longer convey the same information. Specifically, variables with the same primary loadings can have a different sum of the remaining loadings, and the reverse also holds. Thus, in selecting variables to obtain a simple solution one can consider both the primary and the remaining loadings. For simplicity, but without loss of generality, we restrict our discussion to the case of $K = 2$. The generalization to a $K > 2$ dimensional subspace can be found elsewhere (Gallucci & Perugini, 1998).

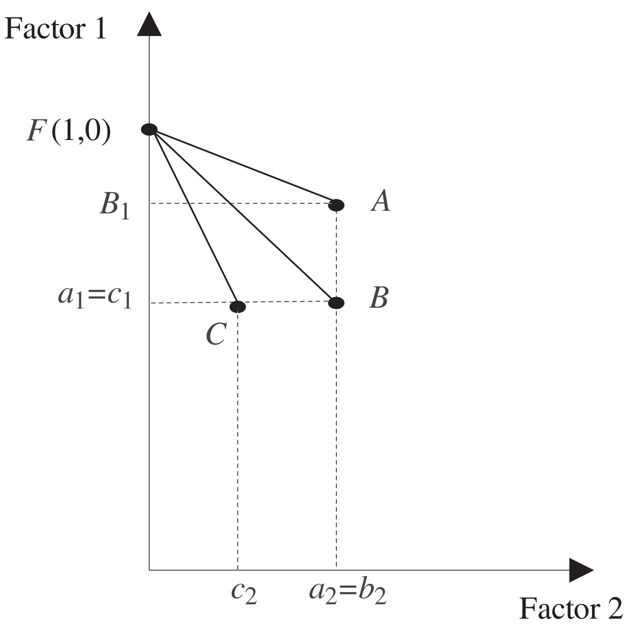

Figure 1. Graphic representation of three variables in a bifactorial space

Consider a bifactorial space with a variable A with loadings (a_1, a_2), a variable B (b_1, b_2), such that $b_1 > a_1$ and $b_2 = a_2$, and a variable C (c_1, c_2), with $c_1 = a_1$ and $c_2 < a_2$ (see Figure 1).

Variables B and C are better markers of Factor 1 than variable A (i. e., B has a higher primary loading on Factor 1 than A, C has a lower secondary loading on Factor 2). Variables C and B are closer to Factor 1 than variable A and are therefore simpler. To capture this property, we now consider the point F with coordinates (1,0). One can note that both the distances between B and F and between C and F are smaller than the distance between A and F (see Figure 1). Since point F represents the ideal position of the factorially simplest adjective, the simpler the adjective, the lower the distance. The distance depends on both the primary and the secondary loading, and it captures the factorial simplicity and purity of the adjective. We call this distance the *vertex distance*.

To calculate the vertex distance in a bifactorial space for a generic item I, we take the Euclidean distance between the item I with coordinates (l_1, l_2) and the point F with coordinates (1,0):

$$\text{vertex distance} = \|F - I\| = \sqrt{(1-l_1)^2 + (l_2)^2}$$

However, the length of the vertex distance is inversely related to the "purity" of an item of a factor. Thus, for simplicity, we reverse the direction, such that a higher value indicates that the adjective is a better marker of the factor. (This formula differs from the previous formula of Marker Index (see above) because it is restricted to the bifactorial space.) Therefore, the corresponding Marker Index in a bifactorial space will be:

$$\text{MI} = 1 - \sqrt{(1-l_1)^2 + (l_2)^2}$$

We now stress some logical properties of this approach to the selection of markers, briefly comparing the Marker Index to some loadings-based alternative criteria.

First, note that two items can have the same vertex index only if any difference in their primary loadings is counterbalanced by a difference in their secondary loadings (Figure 2a). This property is the key feature of the Marker Index: The simplicity of an item is inferred considering both primary and secondary loadings. The main ingredient of the Marker Index is the primary loading, but it incorporates a penalty for secondary loading, a penalty that becomes progressively heavier as the secondary loading increases. (We thank Wim Hofstee for this definition effectively expressing the main feature of the Marker Index.)

An alternative approach is to rank the items, using the highest loading on a given factor. With this approach (*primary loading* criterion), variables with the same primary loadings but with different secondary loadings are considered as equal, even though it should be straightforward to select as a better marker of a given factor an item that, having the same value on that factor, has less in another factor. However, we would not reach this conclusion if we were to use only primary loadings to select the best markers. In contrast, the Marker Index has the property that, for any two items with equal primary loadings, the higher the secondary loading, the lower the value of the Marker Index (see Figure 2b).

Another criterion would be to use the *angular distance* (AD). Gallucci and Perugini (1998) show that the angular distance, for any dimensional subspace, is formally

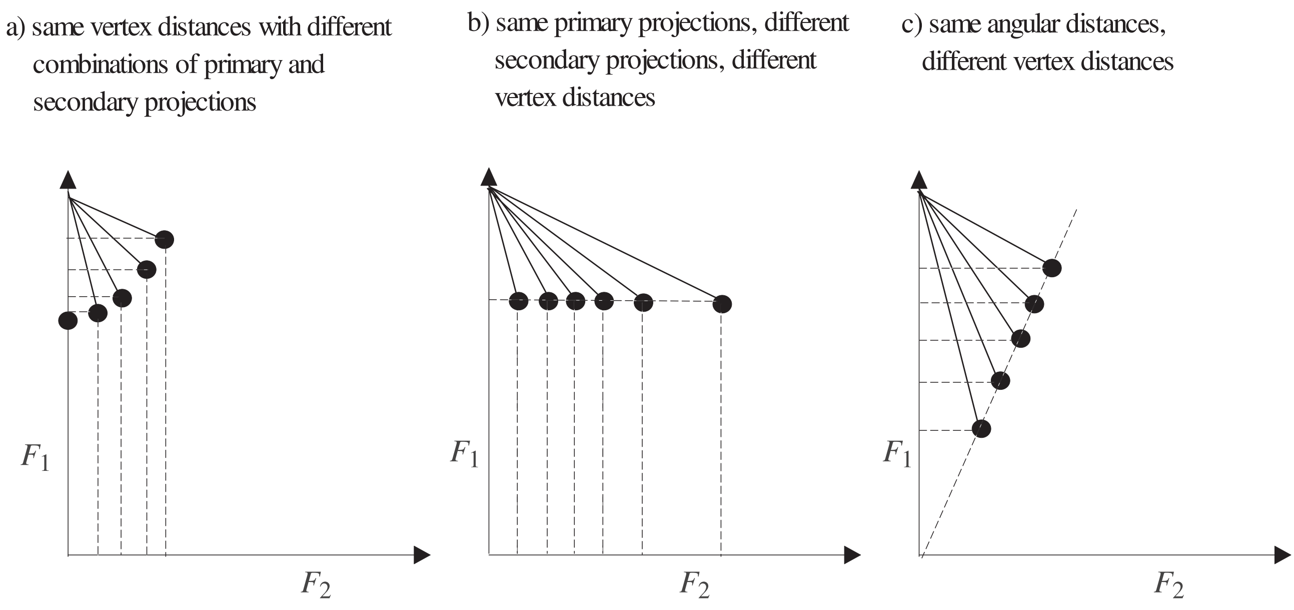

Figure 2. Graphic representation of the vertex distance and comparisons with alternative criteria

equivalent in terms of ranking to an index proposed by Furntratt, a ratio between the variance of the variable on the proper factor and the variance of the variable on all the factors in the factorial solution. Moreover, they show that the angular distance is empirically almost equivalent to another criterion, the Index of Factorial Simplicity (Kaiser, 1974). The angular distance expresses the distance, in degrees, between an item and a factor, and it can be calculated in a bifactorial space as follows:

$$AD = \arctan\left(\frac{l_2}{l_1}\right)$$

where l_1 and l_2 refer to the primary and the secondary loading, respectively.

Thus, we might use the angular distance as a criterion (see Figure 2c). (Note that the inversion within primary and secondary loadings takes place at 45°. Thus, for simplicity's sake, our reasoning with angular distances is applied assuming that the primary and secondary loadings are still the same. In other words, the angular distance from the proper factor is less than 45°.) However, we would consider items as equivalent when they have the same angular distance but with different combinations of primary and secondary loadings. For instance, an angular distance of 10.5° can result from a primary factor loading of 0.25 and a secondary factor loading of 0.05, as well as from a primary factor loading of 0.75 and a secondary factor loading of 0.15.

To conclude, the issue is not simply to consider simultaneously the primary and the secondary loading; the point is how to *combine* these two sources of information. The Marker Index is one way to combine primary and secondary loadings such that the information provided can be used to effectively select the best markers of a factor.

Goal

The main goal of this contribution is the application of the above-described methodology to the Big Five factors. This methodology is specifically aimed at individuating a simple factorial structure. By using the proposed methodology, we select the best markers among the adjectives used for the measurement of the Big Five. In particular, the starting pool of adjectives includes the Goldberg markers list (Goldberg, 1992), the IASR-B5 (Trapnell & Wiggins, 1990) and the SACBIF (Perugini & Leone, 1996). The factorial structure deriving from the selected markers is used to investigate the properties of the instruments.

Method

Subjects and Procedure

The sample was composed of 337 subjects, 210 females and 127 males, with a mean age of 21.69 (SD = 2.69). They were mostly Italian undergraduate students from different academic disciplines, recruited at the university campus of the University of Rome, "La Sapienza." The measures were administered individually, and subjects were assured that their personal data would be used for scientific purposes. In order to preserve anonymity, they were not asked to give their names.

Instruments

In the present study, we selected a starting pool of adjectives resulting from the combination of three validated adjective lists developed to measure the Big Five factors. The instruments were the Goldberg markers list (Goldberg, 1992), the IASR-B5 (Trapnell & Wiggins, 1990) and the SACBIF (Perugini & Leone, 1996). All three lists contain adjectives aimed at measuring Big Five personality factors. Whereas SACBIF is an Italian list, the other two lists are composed of English adjectives that have been translated by the present authors into Italian. The three lists differ in specific characteristics:

– The Goldberg markers were specifically developed as a representative sampling of the Big Five domain, with the aim of obtaining a relatively short list showing a simple orthogonal structure, and with the same number of adjectives for each factor (Goldberg, 1990, 1992). The instrument has been used in several studies. Evidence has been provided for convergent and discriminant validity and for robustness across different measurement techniques, samples and ratings (Goldberg, 1992).
– The IASR-B5 by Trapnell and Wiggins (1990) was developed as a measure of the Big Five coming from a research line different from the psycholexical tradition. The authors developed the instrument as an integration of the Interpersonal Circumplex and Big Five models. For this reason IASR-B5 provides adjectives measuring Dominance and Nurturance, with the addition of three adjective clusters for Conscientiousness, Neuroticism and Openness to Experience. Besides information regarding "interpersonal space," the IASR-B5 provides markers of the Big Five factors.
– The SACBIF (Perugini & Leone, 1996) is an adjective list developed in the Italian context, starting from a pool of 492 Italian adjectives. These were reduced to a short list of 50 adjectives, 5 for each pole of each factor of the Big Five. SACBIF has been tested in

various samples, and has been shown to be robust across gender. Like the previous two instruments, the SACBIF provides a measure for the Big Five.

The resulting adjectives pool was formed as follows: The Goldberg markers included 100 adjectives, the SACBIF 50 adjectives, and from the IASR-B5 we extracted 92 adjectives measuring the Big Five. The three lists were united in one instrument with 197 adjectives: 5 were present in all three lists, 23 were in the Goldberg list and the IASR-B5, 8 were in the SACBIF and the Goldberg list, and 5 were in the IASR-B5 and the SACBIF. In terms of the Big Five factors, we had 37 adjectives for Extraversion, 39 for Agreeableness, 38 for Conscientiousness, 41 for Emotional Stability/Neuroticism, and 41 for Openness to Experience/Intellect.

One adjective was added to counteract the loss of a degree of freedom in the ipsatization (see later). The subjects received a randomized list of 197 adjectives with the instruction to rate themselves using a seven-point Likert scale, ranging from 0 *(not at all)* to 6 *(absolutely).*

Data Analyses

Data were ipsatized (cf. Hofstee, De Raad, & Goldberg, 1992; Perugini & Leone, 1996). We performed two sets of analyses. In the first set a list of best Big Five markers was selected with the aim of identifying a very simple five-factorial structure. The resulting structure was our Big Five benchmark structure. Reliability, expressed through Cronbach's α, and scale validity (cf. Cattell, 1952; Ten Berge & Knol, 1985), expressed through the correlation between scale and component, were calculated to investigate the psychometric properties of the factors. With the second set of analyses we intended to investigate the relations and the differences among the instruments, as they were recovered in the Italian language.

Results and Discussion

The Simple Big Five Factors Structure

Using the whole set of adjectives (N = 196), an overall Principal Component Analysis (PCA) with Varimax rotation was performed to extract five independent factors. A clear elbow was present between the fifth and the sixth eigenvalue. (The eigenvalues from factors 1 to 8 were 19.54, 18.65, 10.86, 8.85, 7.41, 4.50, 3.51, 3.26, respectively.) The five-factor solution explained 33% of the total variance. The five factors were clearly the Big Five. Among the 196 adjectives, 153 (78.1%) loaded where they were expected to load, 24 (12.2%) were misplaced (they showed a primary loading on another factor), and 19 (9.7%) were not well represented by the five factor solution (they had a primary loading < |30|). From this first round 177 adjectives were selected.

Using the Marker Index, the best five adjectives were selected for each pole of each factor. A PCA was performed on this reduced set of 50 adjectives, extracting five factors with Varimax rotation. The five factors explained 50.9% of the total variance, with the eigenvalues obviously showing a marked elbow between the fifth and sixth factor. (The eigenvalues from factors 1 to 8 were 6.98, 5.49, 4.84, 4.49, 3.67, 1.47, 1.36, 1.31, respectively.) Factor loadings and Marker Index values are reported in Table 1.

The factor loadings were generally very high in absolute value, ranging from 0.86 *(Nervous)* to 0.41 *(Conformist)*. All factors had loadings ranging between 0.50 and 0.90, except Factor V, where three adjectives had loadings between 0.40 and 0.50. The structure was clearly factorially simple, with no secondary loadings higher than 0.30 and with only eight of the 200 possible secondary loadings higher than 0.20 (4.0%). The Marker Index value varied between .79 *(Nervous)* and .32 *(Conformist)*.

The contribution of each instrument to the common factor solution was basically the same, with a slight minority for the SACBIF (23 adjectives included in the final structure from IASR-B5, 25 from Goldberg scale, and 16 from the SACBIF. (Note: The adjectives did not sum up to 50 because some of them were common to two or three instruments. If we consider the proportion of selected adjectives with respect to the number of adjectives contained in each instrument, the values were approximately equal: we selected 25% of the IAS-B5 adjectives, 25% of the Goldberg adjectives and 32% of the SACBIF adjectives.) The five factors, as defined by the selected adjectives, were consistent with the Big Five as usually defined. The reliabilities of the five factors (Cronbach's α) were good: 0.88, 0.86, 0.90, 0.92, 0.80, 0.87, respectively. The scale validities were also good, with values of 0.98, 0.98, 0.99, 0.99, 0.99, respectively. These values imply that the factorial structure was very simple, as the scales overlapped strongly with the components that, due to the Varimax rotation, are strictly orthogonal.

In conclusion, we obtained a very simple structure of the Big Five. This structure meets the criteria of a good benchmark structure. The next step was to consider the relations among the instruments, i. e., the different operationalizations of the Big Five, using this benchmark structure.

Table 1. Factorial solution for the 50 selected adjectives.

		Factors I		II	III	IV	V	MI
Adjective	OF	OI		Factor Loadings				
Extraverted	I	SG	*.80*	.09	–.09	.05	–.02	*.75*
Sparkling	I	S	*.73*	.04	–.01	.02	.08	*.71*
Sprightly	I	S	*.69*	.00	–.05	–.07	–.06	*.67*
Overwhelming	I	S	*.67*	–.11	.02	.00	.21	*.60*
Bold	I	G	*.61*	–.13	–.01	.06	–.04	*.58*
Withdrawn	I	G	*–.76*	–.09	–.03	–.07	–.01	*.73*
Introverted	I	SG	*–.74*	–.15	.01	–.05	.04	*.69*
Untalkative	I	SG	*–.71*	–.11	.06	.04	.04	*.68*
Shy	I	IG	*–.69*	.20	–.02	.02	.00	*.62*
Unbold	I	I	*–.56*	.18	–.02	–.02	–.03	*.52*
Soft–hearted	II	I	–.00	*.78*	.01	.04	–.02	*.78*
Tender	II	I	.06	*.75*	.06	.03	.05	*.73*
Tender-hearted	II	I	–.09	*.72*	–.07	–.00	.15	*.67*
Charitable	II	I	.04	*.65*	–.02	.13	.02	*.63*
Considerate	II	G	–.02	*.56*	.11	.04	.01	*.54*
Iron–hearted	II	I	.13	*–.73*	.05	–.02	–.10	*.67*
Unsympathetic	II	G	.03	*–.68*	–.08	.05	–.11	*.65*
Cold	II	G	–.19	*–.59*	.04	.05	.02	*.54*
Unexcitable	II	G	.05	*–.58*	.03	.09	.01	*.56*
Cynical	II	S	.10	*–.51*	–.03	–.18	.10	*.46*
Organized	III	I,G	.11	–.05	*.77*	.11	–.05	*.71*
Neat	III	I,G,S	–.09	.09	*.75*	.14	–.10	*.67*
Tidy	III	I,S	–.08	.04	*.71*	.15	–.09	*.65*
Planful	III	I	.03	–.01	*.70*	.01	.10	*.68*
Thorough	III	I,G	–.13	.04	*.65*	.05	.02	*.62*
Disorganized	III	I,G	–.08	–.05	*–.80*	–.07	–.10	*.75*
Disorderly	III	S	.03	–.08	*–.74*	–.07	.00	*.72*
Unorderly	III	I	.02	.01	*–.72*	–.04	–.13	*.69*
Untidy	III	I	–.02	.04	*–.71*	.01	–.14	*.67*
Unsystematic	III	I,G	.00	.06	*–.66*	–.04	–.02	*.65*
Unnervous	IV	I	.06	.01	.05	*.83*	.13	*.77*
Unagitated	IV	I	–.11	.04	.04	*.78*	.04	*.74*
Relaxed	IV	I,G	.08	–.03	.01	*.74*	.06	*.72*
Calm	IV	I,S	–.27	.09	.10	*.69*	.01	*.57*
Unanxious	IV	I	.12	–.17	–.02	*.67*	–.07	*.60*
Nervous	IV	I,G	–.09	–.07	–.08	*–.86*	–.07	*.79*
Tense	IV	I	–.15	.02	–.07	*–.82*	–.06	*.75*
Neurotic	IV	S	.02	–.05	–.16	*–.77*	.09	*.70*
Irritable	IV	G	.02	–.18	–.02	*–.68*	–.11	*.62*
Hysterical	IV	S	–.00	–.04	–.17	*–.68*	–.00	*.63*
Philosophical	V	I,G	–.12	.02	–.09	.05	*.79*	*.74*
Intellectual	V	S,G	.01	–.10	.13	.15	*.69*	*.62*
Artistic	V	G	.19	.09	.06	–.01	*.54*	*.49*
Deep	V	G	–.03	.23	.05	.12	*.52*	*.45*
Introspective	V	G	–.23	.15	–.16	.03	*.49*	*.39*
Unphilosophical	V	I	.03	–.01	.05	.05	*–.74*	*.73*
Unintellectual	V	G	–.01	.08	–.22	.01	*–.68*	*.60*
Unartistic	V	I	.05	–.16	–.16	–.07	*–.55*	*.49*
Uncreative	V	G	–.29	.05	–.08	.07	*–.49*	*.40*
Conformist	V	S	–.14	.19	.21	–.05	*–.41*	*.32*

Note: OI = Original instrument; G = Goldberg's markers, I = IASR-B5, S = SACBIF; OF = Original Factor; I = Extraversion or Surgency, II = Agreeableness, III = Conscientiousness, IV = Emotional Stability or (inverse of) Neuroticism, V = Intellect or Openness to Experience. MI = Marker Index.

Relationships Among Instruments

We computed the correlations between the five factors derived from the three instruments and our benchmark factors (Table 2). This procedure can be seen as a plot of the factors of each list in the common space. This plot reveals the *position* and the *orientation* of each factor, thus showing possible differences, similarities, and idiosyncrasies of the different definitions of the Big Five by each instrument. Since the space was complete, that is, the plot involved all the five factors, one can analyze the distance from the benchmark factor for each factor (for instance, the distance of the SACBIF Extroversion from the benchmark Factor I) and all the possible shifts of one factor toward the other benchmark factors.

To understand in more detail the differences and similarities between the three instruments, we also computed the correlations between each pole of each factor of the instruments and the benchmark factors (Table 3).

The results showed that, in general, the instruments were convergent, with very high primary correlations with the proper factor and mostly trivial correlations with the other factors.

For Factor I, Goldberg's Surgency and SACBIF's Extraversion were very close to the common factor with correlations equal to 0.91 and 0.95, respectively, whereas the IASR-B5's Extraversion showed a primary correlation of 0.71 and a secondary correlation of –0.32 with Factor II. Considering the correlations of the poles, this relative weakness was mostly due to the positive pole of IASR-B5's Extraversion (0.55). Indeed, this factor was defined by Trapnell and Wiggins as referring more to Dominance (e. g., *Dominant, Assertive*) than to the energetic core of Extraversion.

As regards Factor II, IASR-B5's Agreeableness seemed to be the most prototypic (0.89), whereas SACBIF's Agreeableness was the least prototypic (0.66). The factors defined by Goldberg and SACBIF showed secondary correlations with Factor IV of 0.35 and 0.34, respectively. These secondary correlations were also present considering SACBIF's negative Agreeableness and considering both poles of Goldberg's Agreeableness, whereas they were less evident in the case of SACBIF's positive Agreeableness.

For Factor III, all three instruments converged equally well on the common factor, both at the factor and at the poles level, thus showing an equivalence in the operationalization of Conscientiousness.

As regards Factor IV, the primary correlations were high, even though for the Goldberg factor we found, as was the case in reverse order for Factor II, a shift of Emotional Stability toward Factor II (correlation with Factor IV of 0.71 and with Factor II of –0.33). The correlations of the poles (Table 3) showed that the shift was due to the positive pole of Emotional Stability, which was almost equally correlated with Factor IV and Factor II (0.49 and –0.43, respectively). The dual shift of Goldberg's Agreeableness and Emotional Stability implied that the space defined by these two factors was rotated about 25° from the space defined by Factor II and Factor IV.

Finally, for Factor V Goldberg's factor and IASR-B5's factor were the most prototypical components, whereas SACBIF's factor showed an idiosyncratic position, with

Table 2. Correlations among the factors of the three instruments and the benchmark factors.

List	Fac.	Factor I	Factor II	Factor III	Factor IV	Factor V
Goldberg	Surg.	*.91*	–.09	–.12	.01	.05
	Agre.	.11	*.70*	–.02	.35	–.06
	Con.	.01	.06	*.90*	.15	.00
	ES	.19	–.33	–.01	*.71*	–.04
	Intel.	.16	–.04	.09	–.04	*.82*
IASR-B5	Ex.	*.71*	–.32	.08	.05	.05
	Agre.	–.11	*.89*	.05	.13	.09
	Con.	–.03	.04	*.94*	.13	.03
	Neu.*	.20	–.15	.08	*.87*	.02
	OpE	.02	.10	.01	.04	*.84*
SACBIF	Ex.	*.95*	–.00	–.06	–.02	.05
	Agre.	–.08	*.66*	–.00	.34	–.10
	Con.	–.15	.15	*.84*	.12	.01
	ES	.13	–.00	.20	*.89*	–.05
	OpE	.35	–.11	–.27	.08	*.48*

Notes: Surg. = Surgency; Ex. = Extraversion; Agre. = Agreeableness; Con. = Conscientiousness; ES = Emotional Stability; Neu. = Neuroticism; Intel. = Intellect; OpE = Openness to Experience.
*IASR-B5 Neuroticism was considered reversing the polarity.
Correlations greater than .17 are significant with $p < .001$.

Table 3. Correlations among the poles of the three instruments and the benchmark factors.

List	Fac.	P*	Factor I	Factor II	Factor III	Factor IV	Factor V
	Surg.	+	*.82*	–.09	–.14	.07	.07
		–	*–.88*	.08	.09	.05	–.02
	Agre.	+	.18	*.63*	.02	.34	–.12
		–	–.03	*–.66*	.05	–.30	.00
	Con.	+	–.08	.06	*.85*	.16	–.05
Goldberg		–	–.10	–.04	*–.79*	–.11	–.05
	ES	+	.08	–.43	–.11	*.49*	–.14
		–	–.26	.15	–.09	*–.77*	–.08
	Intel.	+	.17	.02	.00	.08	*.85*
		–	–.12	.10	–.16	.15	*–.61*
	Ex.	+	*.55*	–.31	.09	.16	.06
		–	*–.74*	.28	–.06	.08	–.03
	Agre.	+	–.11	*.86*	–.00	.16	.05
		–	.08	*–.76*	–.09	–.07	–.11
IASR-B5	Con.	+	–.07	.04	*.92*	.14	–.02
		–	–.01	–.03	*–.88*	–.12	–.08
	Neu.**	+	.11	–.06	.14	*.88*	.01
		–	–.27	.22	–.01	*–.78*	–.02
	OpE	+	.05	.12	.04	.18	*.74*
		–	.00	–.06	.02	.10	*–.78*
	Ex.	+	*.90*	–.02	–.05	–.02	.10
		–	*–.88*	–.02	.06	.03	.00
	Agre.	+	–.08	*.62*	–.06	.20	–.06
			–.07	*–.53*	–.05	–.39	.11
	Con.	+	–.16	.08	*.83*	.09	–.04
SACBIF		–	.12	–.20	*–.74*	–.13	–.05
	ES	+	.06	.04	.23	*.75*	–.06
		–	–.17	.04	–.15	*–.89*	.03
	OpE	+	.38	–.10	–.15	.10	*.47*
		–	–.23	.09	.32	–.04	*–.37*

Notes: Surg. = Surgency; Ex. = Extraversion; Agre. = Agreeableness; Con. = Conscientiousness; ES = Emotional Stability; Neu. = Neuroticism; Intel. = Intellect; OpE = Openness to Experience. P* = Pole. ** IASR-B5 Neuroticism was computed with the same polarities as Emotional stability. Correlations greater than .17 are significant at $p < .001$.

a low primary correlation (0.48) on Factor V and a relatively high secondary correlation (0.35) on Factor I. This result was confirmed considering the positive pole of SACBIF's Openness to Experience, whereas we found a different pattern for the negative pole. In fact, SACBIF's Closedness to Experience showed a primary correlation of –0.37 with Factor V, a secondary correlation with Factor III of 0.32 and a tertiary correlation with Factor I of –0.23.

To put our discussion on firmer ground, we used the AB5C coding system (Hofstee, De Raad, & Goldberg, 1992) as a reference. This is the "state-of-art" modeling approach in the field of personality structure, in particular as regards the Big Five. Briefly, the elegant and appealing procedure of the AB5C consists of assigning the variables to the space defined by their two highest loadings. This bifactorial space is divided in 12 equally spaced hypothetical factors. From the two loadings, projections of the variables on the 12 hypothetical factors are calculated. Finally, variables are classified as belonging to the hypothetical factor on which they have the highest projection.

Using this procedure, the relative merits of the factors and poles of the three instruments can be easily unfolded (see Table 4).

The first, third, and fifth factor of Goldberg were pure markers, whereas the second factor had a Factor IV connotation and the fourth factor had a negative Factor II connotation on the positive pole and a negative Factor I connotation on the negative pole.

The second, third, and fifth factor of IASR-B5 were pure markers. The first factor had a negative Factor II connotation and the negative pole of the fourth factor had a negative Factor I connotation.

The first and the third factor of SACBIF were pure markers, whereas the second factor had a Factor IV connotation and the positive pole of the fourth factor had a Factor II connotation. The positive pole of the fifth factor

Table 4. AB5C coding of the factors of the three instruments.

Instrument	Factor	General	AB5C coding Positive pole	Negative pole
Goldberg	Surgency	I+	I+	I–
	Agreeableness	II+ IV+	II+ IV+	II–IV–
	Conscientiousness	III+	III+	III–
	Emotional Stability	IV+ II–	IV+ II–	IV–I–
	Intellect	V+	V+	V–
IASR-B5	Extraversion	I+ II–	I+ II–	I–II+
	Agreeableness	II+	II+	II–
	Conscientiousness	III+	III+	III–
	Neuroticism*	IV+	IV+	IV–I–
	Openness to Experience	V+	V+	V–
SACBIF	Extraversion	I+	I+	I–
	Agreeableness	II+ IV+	II+ IV+	II–IV–
	Conscientiousness	III+	III+	III–
	Emotional Stability	IV+	IV+ II+	IV–
	Openness to Experience	V+ I+	V+ I+	V–III+

* IASR-B5 Neuroticism was considered reversing the polarity.

had a Factor I connotation and its negative pole had a Factor III connotation.

Thus, if one wishes to apply the existing subscales of the three instruments to measure the factorially simple Big Five, one should preferably measure Factor I with the first factor of Goldberg or of SACBIF, Factor II with the second factor of IASR-B5, Factor III with any of the three measures, the positive pole of Factor IV with IASR-B5 and the negative pole with SACBIF, and Factor V with Goldberg or IASR-B5.

Conclusion

In this contribution we proposed a methodology to find a simple factorial structure, and we applied this methodology to the domain of Big Five as measured by adjectives. We proposed a five-factor benchmark structure derived by taking the 50 best marker adjectives in the Italian language. We then used this common factor structure (or benchmark structure) to investigate the differences and the similarities between three operationalizations of the Big Five (i. e., Goldberg's 100 adjectives list, IASR-B5, and SACBIF) as they emerged in the Italian language.

We would like to highlight some benefits of using a common factor structure approach from a methodological point of view. The common structure approach reduces the dimensionality of the space representing a hypergeometrical representation to a single vector (the common factor). This is true also if one has to analyze a large number of variables, since the single dimension is the best structure of the variables space, independently of the number of variables involved. Thus, one can compare and analyze a very large number of variables using the simple structure as a reference point, avoiding the complexity and intractability of large numbers, and not being dependent on change of the space when a variable is added or removed from the analysis. A common structure functions like the mean on a distribution of values:

- It is the best representative value of the distribution,
- It is the best value of comparison for the other values,
- it is the simplest value one can use.

In this respect, it is of crucial importance to use a methodology that guarantees having a simple factorial structure. The Marker Index represents a viable option to easily and optimally achieve this aim.

One limitation of our study is that we used a single sample to select the marker variables and then to analyze them again. A future study should validate the results and investigate whether the simple factorial structure and the basic psychometric properties of the scales would be maintained.

As regards the substantial interpretation of the results, we hesitate to extend these results to other cultures and languages directly. On a general level, similarities between cultures may prevail and "universal" structures or systems can be reasonably agreed on. However, when using a more fine-grained level of analysis, as we did here, differences between cultures are likely to play a role. The specific positioning of some poles or scales may shift between cultures, and inferences at this level are not guaranteed to be generalizable directly to other languages. *Ad hoc* studies are needed to address the issue of cross-cultural stability.

Instead, we believe that the proposed methodology may be of a general usefulness. We would suggest that researchers should apply this methodology or a similar one in their culture if they wish to set a simple Big Five structure. The results will be better than those obtained from directly using scales formed by adjectives which have been shown to measure the Big Five in other countries.

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