

# MSP Research Note

## B5PQ Reliability, Validity and Norms

### Introduction

This research note describes the reliability and validity of the B5PQ. Evidence for the reliability and validity of is presented against some of the key the criteria in the EFPA Review Model for the Description and Evaluation of Psychological Tests (Bartram, 2002). The EFPA Review Model was produced to support and encourage the process of harmonising the reviewing of tests. It provides a standard set of criteria to assess the quality of tests. These cover the common areas of test review such as norms, reliability and validity.

### Reliability

#### Internal consistency reliabilities

Table 1 presents internal consistency estimates based on Cronbach's Coefficient Alpha together with raw score SEMs for B5PQ. Overall, the B5PQ has good internal consistency reliability with a median scale reliability of 0.80.

- **Extraversion.** The Extraversion factor reliability is 0.90 and the trait scale reliabilities range from 0.70 to 0.81.
- **Agreeableness.** The Agreeableness factor reliability is 0.83 and the trait scale reliabilities range from 0.69 to 0.82.

- **Openness to Change.** The Openness to Change factor reliability is 0.88 and the trait scale reliabilities range from 0.69 to 0.84.

**Table 1.** Internal consistency reliabilities for B5PQ (N = 1,393)

Scale	Alpha	Mean	SD	Raw Score SEm
Extraversion	0.92	78.74	17.12	4.84
Agreeableness	0.83	81.32	12.26	5.05
Openness to Change	0.88	74.84	14.60	5.06
Conscientiousness	0.92	87.00	17.46	4.94
Emotional Stability	0.94	80.42	20.75	5.08
E1: Friendly	0.81	21.27	5.72	2.49
E2: Outgoing	0.79	18.51	5.77	2.64
E3: Assertive	0.76	19.07	5.20	2.55
E4: Energetic	0.70	19.89	4.70	2.57
A1: Trusting	0.82	20.90	5.36	2.27
A2: Genuine	0.74	22.14	4.39	2.24
A3: Considerate	0.79	22.52	4.36	2.00
A4: Unassuming	0.69	15.75	5.15	2.87
O1: Imaginative	0.69	19.69	4.50	2.51
O2: Innovative	0.84	20.41	5.37	2.15
O3: Rule-Breaking	0.70	14.48	4.75	2.60
O4: Adaptable	0.79	20.26	5.02	2.30
C1: Competent	0.76	22.78	4.54	2.22
C2: Organised	0.74	20.60	5.29	2.70
C3: Achieving	0.82	23.31	5.55	2.35
C4: Proactive	0.81	20.32	5.43	2.37
S1: Relaxed	0.78	18.51	5.66	2.65
S2: Contented	0.86	21.71	6.37	2.38
S3: Self-Assured	0.79	19.79	5.77	2.64
S4: Resilient	0.82	20.41	5.80	2.46
IM: Impression Management	0.81	50.68	10.14	4.42

**Table 2.** B5PQ test-retest reliability (N = 56)

Scale	Mean	SD	Mean	SD	Reliability
F1: Extraversion	5.62	1.67	5.83	1.62	0.85
F2: Agreeableness	5.55	1.33	5.84	1.32	0.83
F3: Openness to Change	5.70	1.27	5.64	1.44	0.85
F4: Conscientiousness	5.87	1.72	6.09	1.74	0.88
F5: Emotional Stability	5.54	1.70	5.88	1.66	0.91
E1: Friendly	5.71	1.88	6.02	1.77	0.81
E2: Outgoing	5.55	2.22	5.54	2.17	0.87
E3: Assertive	5.84	1.92	5.98	1.69	0.74
E4: Energetic	5.38	2.35	5.79	2.24	0.91
A1: Trusting	5.59	1.76	5.79	1.88	0.76
A2: Genuine	5.59	2.15	5.96	2.11	0.74
A3: Considerate	5.63	2.01	5.71	1.90	0.73
A4: Unassuming	5.41	1.83	5.91	1.86	0.74
O1: Imaginative	5.52	2.05	5.29	2.40	0.73
O2: Innovative	5.71	1.84	5.80	1.78	0.77
O3: Rule-Breaking	5.77	1.68	5.66	1.94	0.76
O4: Adaptable	5.80	1.84	5.82	1.95	0.83
C1: Competent	5.80	2.05	6.02	1.98	0.87
C2: Organised	5.91	1.85	5.95	1.78	0.81
C3: Achieving	5.98	2.20	6.32	2.18	0.84
C4: Proactive	5.75	2.05	6.05	2.00	0.88
S1: Relaxed	5.45	1.65	6.04	1.85	0.79
S2: Contented	5.59	2.15	6.02	2.00	0.87
S3: Self-Assured	5.63	1.88	5.71	1.72	0.84
S4: Resilient	5.50	1.95	5.73	2.00	0.82

- **Conscientiousness.** The Conscientiousness factor reliability is 0.92 and the trait scale reliabilities range from 0.74 to 0.82.
- **Emotional Stability.** The Emotional Stability factor reliability is 0.94 and the trait scale reliabilities range from 0.78 to 0.86.

The B5PQ trait scale SEMs range from 2.00 to 2.87 with a mean SEM of 2.45. This is equivalent to a Sten score SEM of approximately 1. In other words, there is a 68% likelihood that the person's true score on one of the trait scales will lie one Sten either side of the observed score. For the factor scales, the average SEM raw score is approximately 5 which is equivalent to about half a Sten. The SEM bands around the factor scores are smaller because the reliabilities are higher.

### **Retest stability**

Test-retest reliability measures score consistency over time. Table 2 gives information on the reliability of B5PQ. This information is based on 56 respondents who completed the questionnaire with a month in between each administration. The reliability of all the scales is above 0.70 and comparable with the internal consistency estimates. The median reliability for the Big Five scales is 0.85 with a range of 0.83 to 0.91. For the primary scales, the median test-retest reliability is 0.81 with a range of 0.73 to 0.91.

### **Construct Validity**

#### **Scale intercorrelations**

Table 3 shows the intercorrelations of the B5PQ scales. At the factor level, we can observe moderate correlations between some of the factors. Extraversion correlates positively with Openness to Change, Conscientiousness and Emotional Stability. Agreeableness has moderate correlations with Conscientiousness and Emotional Stability. These patterns are also found in the NEO-PI-R. At the trait level, the strongest correlations are, predictably, within each of the five factors, that is, between the scales that make up each of the five factors.

#### **Intercorrelations and reliability**

In order to determine how well a personality questionnaire differentiates between the different dimensions it is designed to measure, it is necessary to correct the correlations for unreliability. A correlation needs to be divided by the square root of the product of the two variables' reliability to determine what the correlation between the two variables would be if the variables' reliabilities were perfect. If two scales share less than 50% reliable variance, then we can be reasonably certain that they are independent.

Table 4 shows the percentage of common reliable variance for the B5PQ scales and reveals a predictable pattern of relationships. In general, the strongest relationships

between scales are within each factor but even here the majority have less than 50% common reliable variance.

- **Big Five Factors.** All the five factor pairs share less than 25% common variance. The Agreeableness factor pairs share 5% or less common variance.
- **Extraversion Scales.** All the scale pairs share less than 50% common variance except the Friendly/Outgoing scale pair that has 55% common variance. The Extraversion scales show moderate amounts of overlap with the Self-Assured scale in the Emotional Stability factor. The Energetic scale shows moderate amounts of overlap with three of the four Conscientiousness scales (though less than 50%).
- **Agreeableness Scales.** All the scale pairs have less than 25% common variance. The majority of scale pairs outside the factor share less than 10% common variance. The Trusting scale shows a degree of overlap with the Emotional Stability Factor and its constituent elements.
- **Openness to Change scales.** The Innovative and Adaptive scales share 53% common variance but otherwise there is a good degree of independence between the scales. The Innovative scale has moderate degrees of overlap with facets of Extraversion, Conscientiousness and Emotional Stability.
- **Conscientiousness Scales.** There is a high degree of overlap (71%) between the Competent and Achieving scales and overlap at approximately 50% common variance between the Proactive/Competent pair and the Proactive/Achieving pair. The Energetic scale in the Extraversion factor shares common reliable variance of between 39% and 49% with three of the facets of Conscientiousness.
- **Emotional Stability Scales.** All the pairs of scales within the factor show moderate levels of overlap, that is, between 33% and 59%. The Self-Assured scale also shows moderate degrees of overlap with the Extraversion scales.

These findings can be summarised as follows. At the level of the five factors, the B5PQ questionnaire differentiates effectively between the constructs it measures. At the trait level, the pattern is more complicated. Within the five factors, with the exception of the Agreeableness factor, there is less differentiation between the scales, especially between the elements of Emotional Stability. Outside the five factors, the trait scales show a fair degree of independence with three exceptions – the Energetic, Innovative and Self-Assured scales show moderate degrees of overlap with other trait scales (except the Agreeableness ones).

### **Standard Error of Difference**

The Standard Error of Difference (SEd) helps us determine the size of the gap that you need to see between a person's scores on any two scales before you can conclude that the difference is real. The SEd depends on the reliability of the scales – the higher the reliability the smaller the SEd is. If there are two full SEds between the scores on two scales, then there is a 95% likelihood that there is a real difference.

**Table 3.** Intercorrelations of B5PQ scales (N = 1,393)

	Agreeableness	Openness to Change	Conscientiousness	Emotional Stability	E1: Friendly	E2: Outgoing	E3: Assertive	E4: Energetic	A1: Trusting	A2: Genuine	A3: Considerate	A4: Unassuming	O1: Imaginative	O2: Innovative	O3: Rule-Breaking	O4: Adaptable	C1: Competent	C2: Organised	C3: Achieving	C4: Proactive	S1: Relaxed	S2: Contented	S3: Self-Assured	S4: Resilient	Impression Management
Extraversion	0.13	0.34	0.39	0.46	0.72	0.69	0.64	0.56	0.31	0.05	0.27	-0.23	0.06	0.42	0.18	0.38	0.41	0.13	0.42	0.42	0.34	0.40	0.64	0.34	0.56
Agreeableness		-0.02	0.21	0.16	0.23	0.13	-0.06	0.13	0.47	0.58	0.58	0.32	-0.03	0.07	-0.22	0.14	0.19	0.15	0.19	0.20	0.16	0.18	0.08	0.17	0.28
Openness to Change			0.20	0.28	0.25	0.20	0.42	0.30	0.19	-0.08	0.09	-0.22	0.48	0.66	0.58	0.61	0.26	-0.07	0.27	0.24	0.24	0.20	0.33	0.27	0.40
Conscientiousness				0.42	0.29	0.17	0.37	0.53	0.27	0.20	0.28	-0.15	-0.04	0.42	-0.04	0.31	0.74	0.54	0.73	0.75	0.28	0.38	0.38	0.44	0.56
Emotional Stability					0.44	0.31	0.39	0.37	0.40	0.13	0.23	-0.26	-0.02	0.41	0.10	0.41	0.45	0.16	0.39	0.44	0.77	0.77	0.66	0.74	0.66
E1: Friendly						0.60	0.42	0.34	0.33	0.09	0.36	-0.14	0.03	0.31	0.11	0.32	0.31	0.10	0.31	0.31	0.37	0.39	0.58	0.29	0.49
E2: Outgoing							0.39	0.31	0.25	0.03	0.24	-0.15	0.02	0.22	0.11	0.25	0.19	0.04	0.21	0.19	0.23	0.30	0.47	0.17	0.35
E3: Assertive								0.42	0.20	-0.06	0.10	-0.36	0.12	0.48	0.31	0.35	0.41	0.12	0.39	0.38	0.29	0.31	0.56	0.31	0.46
E4: Energetic									0.22	0.11	0.17	-0.13	0.03	0.46	0.12	0.37	0.51	0.21	0.55	0.56	0.25	0.31	0.42	0.38	0.51
A1: Trusting										0.23	0.36	-0.12	0.03	0.27	0.01	0.28	0.29	0.09	0.28	0.27	0.36	0.41	0.33	0.34	0.46
A2: Genuine											0.31	0.12	-0.07	0.04	-0.30	0.09	0.19	0.15	0.19	0.17	0.11	0.17	0.04	0.15	0.21
A3: Considerate												0.04	0.04	0.18	-0.13	0.21	0.28	0.15	0.30	0.25	0.18	0.24	0.21	0.20	0.36
A4: Unassuming													-0.08	-0.26	-0.17	-0.17	-0.22	0.02	-0.22	-0.12	-0.18	-0.28	-0.32	-0.21	-0.21
O1: Imaginative														0.20	0.27	0.16	0.02	-0.12	0.02	-0.05	-0.01	-0.04	0.02	-0.04	0.05
O2: Innovative															0.32	0.57	0.47	0.09	0.47	0.46	0.32	0.32	0.43	0.44	0.57
O3: Rule-Breaking																0.29	0.05	-0.22	0.02	0.02	0.12	0.02	0.18	0.07	0.13
O4: Adaptable																	0.34	0.05	0.36	0.35	0.33	0.33	0.40	0.42	0.52
C1: Competent																		0.32	0.66	0.59	0.33	0.41	0.41	0.48	0.57
C2: Organised																			0.28	0.38	0.10	0.18	0.13	0.18	0.23
C3: Achieving																				0.60	0.25	0.37	0.39	0.42	0.55
C4: Proactive																					0.33	0.39	0.40	0.47	0.57
S1: Relaxed																						0.63	0.51	0.60	0.53
S2: Contented																							0.51	0.59	0.56
S3: Self-Assured																								0.48	0.59
S4: Resilient																									0.59

**Table 4.** Percentage of common reliable variance for B5PQ scales (N =1,393)

	Agreeableness	Openness to Change	Conscientiousness	Emotional Stability	E1: Friendly	E2: Outgoing	E3: Assertive	E4: Energetic	A1: Trusting	A2: Genuine	A3: Considerate	A4: Unassuming	O1: Imaginative	O2: Innovative	O3: Rule-Breaking	O4: Adaptable	C1: Competent	C2: Organised	C3: Achieving	C4: Proactive	S1: Relaxed	S2: Contented	S3: Self-Assured	S4: Resilient	Impression Management
Extraversion	2	16	19	24	64	73	64	47	14	0	13	9	1	29	5	24	25	3	29	24	17	23	59	17	44
Agreeableness		0	5	3	6	2	0	2	34	54	63	18	0	1	8	3	5	4	6	6	4	5	1	4	11
Openness to Change			5	9	8	6	27	14	5	1	2	8	41	70	52	61	10	1	11	8	9	6	16	11	23
Conscientiousness				20	11	5	21	43	11	6	15	4	0	29	0	16	82	47	85	77	12	22	21	29	45
Emotional Stability					25	15	24	21	25	3	9	12	0	28	2	27	31	4	25	27	85	89	65	80	62
E1: Friendly						55	28	17	16	1	24	3	0	15	2	16	14	2	15	14	20	22	50	12	35
E2: Outgoing							24	14	9	0	11	4	0	8	2	10	5	0	7	5	8	13	32	4	17
E3: Assertive								27	6	1	2	23	3	37	15	20	25	2	25	20	12	14	46	14	31
E4: Energetic									8	2	6	3	0	34	2	22	39	7	49	43	9	15	25	21	37
A1: Trusting										9	23	2	0	12	0	13	12	1	13	10	19	25	16	17	30
A2: Genuine											17	3	1	0	14	1	5	4	6	4	2	4	0	3	6
A3: Considerate												0	0	5	3	7	12	4	14	9	5	8	6	6	19
A4: Unassuming													1	11	4	5	7	0	8	2	5	12	15	6	7
O1: Imaginative														7	11	4	0	2	0	0	0	0	0	0	0
O2: Innovative															16	53	33	1	36	30	15	16	27	28	47
O3: Rule-Breaking																14	0	8	0	0	2	0	5	1	3
O4: Adaptable																	17	0	21	17	16	16	23	26	38
C1: Competent																		17	71	48	16	24	25	33	46
C2: Organised																			13	20	1	5	2	5	8
C3: Achieving																				49	9	20	22	26	44
C4: Proactive																					16	23	24	32	46
S1: Relaxed																						59	37	52	40
S2: Contented																							38	52	45
S3: Self-Assured																								33	50
S4: Resilient																									51

**Table 5.** SED of B5PQ scales (N = 1,393)

	Agreeableness	Openness to Change	Conscientiousness	Emotional Stability	E1: Friendly	E2: Outgoing	E3: Assertive	E4: Energetic	A1: Trusting	A2: Genuine	A3: Considerate	A4: Unassuming	O4: Adaptable	O3: Rule-Breaking	O2: Innovative	O1: Imaginative	C1: Competent	C2: Organised	C3: Achieving	C4: Proactive	S1: Relaxed	S2: Contented	S3: Self-Assured	S4: Resilient	Impression management
Extraversion	0.69	0.68	0.63	0.64	0.92	1.14	0.92	0.95	0.95	1.07	1.08	1.06	1.17	0.86	1.10	0.95	0.92	1.13	0.93	0.85	1.04	1.00	0.98	0.95	0.95
Agreeableness		0.71	0.67	0.68	0.95	1.16	0.95	0.97	0.97	1.10	1.10	1.09	1.19	0.89	1.12	0.97	0.95	1.15	0.96	0.88	1.06	1.03	1.01	0.97	0.97
Openness to Change			0.66	0.67	0.94	1.15	0.94	0.97	0.97	1.09	1.10	1.08	1.19	0.88	1.12	0.97	0.94	1.14	0.95	0.88	1.06	1.02	1.00	0.97	0.97
Conscientiousness				0.62	0.91	1.13	0.91	0.93	0.93	1.06	1.07	1.05	1.16	0.85	1.09	0.93	0.91	1.12	0.92	0.84	1.02	0.99	0.97	0.93	0.93
Emotional Stability					0.92	1.13	0.92	0.94	0.94	1.07	1.08	1.06	1.17	0.86	1.10	0.94	0.92	1.12	0.93	0.85	1.03	1.00	0.98	0.94	0.94
E1: Friendly						1.31	1.13	1.15	1.15	1.26	1.27	1.25	1.34	1.08	1.28	1.15	1.13	1.30	1.14	1.08	1.23	1.20	1.18	1.15	1.15
E2: Outgoing							1.31	1.33	1.33	1.42	1.43	1.42	1.50	1.27	1.44	1.33	1.31	1.46	1.32	1.26	1.40	1.37	1.36	1.33	1.33
E3: Assertive								1.15	1.15	1.26	1.27	1.25	1.34	1.08	1.28	1.15	1.13	1.30	1.14	1.08	1.23	1.20	1.18	1.15	1.15
E4: Energetic									1.17	1.28	1.28	1.27	1.36	1.11	1.30	1.17	1.15	1.32	1.16	1.10	1.25	1.22	1.20	1.17	1.17
A1: Trusting										1.28	1.28	1.27	1.36	1.11	1.30	1.17	1.15	1.32	1.16	1.10	1.25	1.22	1.20	1.17	1.17
A2: Genuine											1.38	1.36	1.45	1.21	1.39	1.28	1.26	1.41	1.26	1.21	1.34	1.32	1.30	1.28	1.28
A3: Considerate												1.37	1.46	1.22	1.40	1.28	1.27	1.42	1.27	1.22	1.35	1.32	1.31	1.28	1.28
A4: Unassuming													1.44	1.21	1.39	1.27	1.25	1.41	1.26	1.20	1.34	1.31	1.30	1.27	1.27
O1: Imaginative														1.30	1.47	1.36	1.34	1.49	1.35	1.30	1.43	1.40	1.39	1.36	1.36
O2: Innovative															1.24	1.11	1.08	1.26	1.09	1.03	1.18	1.15	1.14	1.11	1.11
O3: Rule-Breaking																1.30	1.28	1.44	1.29	1.23	1.37	1.34	1.33	1.30	1.30
O4: Adaptable																	1.15	1.32	1.16	1.10	1.25	1.22	1.20	1.17	1.17
C1: Competent																		1.30	1.14	1.08	1.23	1.20	1.18	1.15	1.15
C2: Organised																			1.31	1.26	1.39	1.36	1.35	1.32	1.32
C3: Achieving																				1.08	1.23	1.20	1.19	1.16	1.16
C4: Proactive																					1.18	1.14	1.13	1.10	1.10
S1: Relaxed																						1.29	1.27	1.25	1.25
S2: Contented																							1.24	1.22	1.22
S3: Self-Assured																								1.20	1.20
S4: Resilient																									1.17

The SEs for the Big Five factors are all less than one whereas the SEs for the trait scales are slightly higher (all less than 1.5) reflecting the differences in reliabilities (Table 5). So a difference of 2 Stens or more at the factor level is likely to constitute a real difference whereas at the trait level, you need to see a difference of 3 Stens or more before you infer that the candidate has more of one trait than the other – for example, John has more extravert tendencies than agreeable ones.

## **Factor analysis**

Principal factors extraction with oblique rotation was performed on the B5PQ scales on a sample of 1,810 respondents (see Table 6). It was decided to use oblique rotation because a number of correlations in the factor correlation matrix exceeded 0.30. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.91, well above 0.6 required for a good factor analysis. The numbers in the residual correlation matrix were all very small indicating that the analysis was good.

Five factors were extracted with eigenvalues of 1 accounting for 74% of the variance. The variables were on the whole well-defined by the factor solution. Community values were moderate to fairly high. With a cut-off of 0.40 for the inclusion of a scale in the interpretation of a factor, all the twenty scales loaded on at least one of the five factors.

It is clear that there are five key factors in the solution and that these factors correspond to typical Big Five descriptions but the rotation falls short of Thurstone's criterion of simple structure (Thurstone, 1947). Seven of the variables in the solution were complex; that is, they loaded on more than one factor. These were: Assertive, Energetic, Trusting, Considerate, Innovative, Rule-Breaking and Self-Assured.

The overall factor structure of the B5PQ scales is very similar to the factor structure of the NEO-PI-R scales reported by Costa & McCrae (1992). There are also some similarities in the scales that load on more than one factor. The NEO-PI-R Assertiveness and Activity scales load on the Conscientious factor as the B5PQ Assertive and Energetic scales do. The B5PQ Trusting scale loads on the Emotional Stability factor and the NEO-PI-R Trust scale does on the NEO Neuroticism factor. The B5PQ Considerate scale loads on Agreeableness and Extraversion as does the NEO-PI-R Altruism scale.

## **Relationship to other measures**

In order to assess whether B5PQ measures the Big-Five, we included marker variables in the test development questionnaire. These markers were taken from the International Personality Item Pool (2001) scales developed to measure constructs similar to those in the NEO-PI-R (Goldberg, 1999). Table 7 shows the relationships between these marker variables and the B5PQ scales. The correlations between the B5PQ scales and the marker variables are in the range of 0.74 to 0.86 with a median correlation of 0.80 suggesting that the B5PQ trait scales are measuring similar constructs to the NEO-PI-R facet scales. Note that it was not possible to include marker variables for the Innovative and Rule-Breaking scales because there are no obvious corresponding scales in the NEO-PI-R. These two scales correlate strongly (above 0.70) with relevant scales in the KAI (Kirton, 1994).

**Table 6.** Rotated matrix for B5PQ scales principal factors extraction, oblique rotation (N = 1,810)

Scale	Extraversion	Agreeableness	Openness to Change	Conscientiousness	Emotional Stability
E1: Friendly	-0.86				
E2: Outgoing	-0.93				
E3: Assertive	-0.44	-0.40		0.41	
E4: Energetic	-0.48			0.55	
A1: Trusting	-0.34	0.41			0.44
A2: Genuine		0.70			
A3: Considerate	-0.47	0.65			
A4: Unassuming		0.56			
O1: Imaginative			0.85		
O2: Innovative			0.53	0.48	
O3: Rule-Breaking		-0.42	0.64		
O4: Adaptable			0.51		0.38
C1: Competent				0.74	
C2: Organised			-0.36	0.76	
C3: Achieving				0.82	
C4: Proactive				0.80	
S1: Relaxed					0.96
S2: Contented					0.80
S3: Self-Assured	-0.52				0.42
S4: Resilient					0.84

Note. Loadings under 0.32 are omitted.

**Table 7.** Correlations between selected B5PQ scales and IPIP NEO-PI-R Markers (N = 1,393)

	E1: Friendliness	E2: Gregariousness	E3: Assertiveness	E4: Activity Level	A1: Trust	A2: Morality	A3: Altruism	A5: Modesty	O1: Imagination	O4: Adventurousness	C1: Self-efficacy	C2: Orderliness	C4: Achievement Striving	C5: Self-Discipline	N1: Anxiety	N3: Depression	N4: Self-consciousness	N6: Vulnerability
E1: Friendly	0.84**	0.52**	0.41**	0.25**	0.40**	0.10**	0.022**	-0.32**	0.04	0.28**	0.29**	0.05*	0.27**	0.30**	-0.46**	-0.46**	-0.40**	-0.33**
E2: Outgoing	0.60**	0.74**	0.33**	0.24**	0.29**	0.04	0.12**	-0.30**	0.05	0.27**	0.14**	-0.02	0.17**	0.16**	-0.30**	-0.32**	-0.32**	-0.19**
E3: Assertive	0.37**	0.34**	0.81**	0.37**	0.18**	-0.11**	0.09**	-0.50**	0.09**	0.38**	0.32**	0.06*	0.37**	0.32**	-0.30**	-0.43**	-0.63**	-0.33**
E4: Energetic	0.31**	0.29**	0.53**	0.77**	0.21**	0.08**	0.18**	-0.25**	-0.01	0.37**	0.45**	0.19**	0.57**	0.54**	-0.23**	-0.39**	-0.40**	-0.38**
A1: Trusting	0.34**	0.32**	0.25**	0.24**	0.86**	0.23**	0.28**	-0.23**	0.05	0.30**	0.36**	0.03	0.32**	0.31**	-0.44**	-0.42**	-0.31**	-0.38**
A2: Genuine	0.09**	0.11**	0.01	0.16**	0.28**	0.76**	0.27**	0.04	-0.05	0.10**	0.28**	0.14**	0.30**	0.24**	-0.15**	-0.23**	-0.10**	-0.20**
A3: Considerate	0.39**	0.35**	0.18**	0.17**	0.42**	0.39**	0.78**	-0.06*	0.11**	0.18**	0.33**	0.16**	0.35**	0.29**	-0.23**	-0.25**	-0.14**	-0.26**
A4: Unassuming	-0.19**	-0.13**	-0.38**	-0.19**	-0.07**	0.25**	0.03	0.80**	-0.10**	-0.24**	-0.13**	0.05	-0.12**	-0.12**	0.19**	0.31**	0.38**	0.17**
O1: Imaginative	-0.02	-0.08**	0.06*	-0.07*	0.05	-0.03	0.13**	-0.12**	0.79**	0.22**	-0.03	-0.12**	0.03	-0.12**	0.02	0.06*	0.03	0.05
O4: Adaptable	0.26**	0.24**	0.44**	0.34**	0.29**	0.07**	0.17**	-0.26**	0.17**	0.82**	0.32**	0.02	0.32**	0.33**	-0.39**	-0.41**	-0.44**	-0.46**
C1: Competent	0.26**	0.22**	0.54**	0.46**	0.29**	0.22**	0.25**	-0.31**	0.06*	0.31**	0.78**	0.27**	0.64**	0.59**	-0.37**	-0.54**	-0.49**	-0.55**
C2: Organised	0.07*	0.02	0.18**	0.21**	0.10**	0.19**	0.12**	-0.07**	-0.13**	-0.01	0.38**	0.79**	0.36**	0.54**	-0.08**	-0.22**	-0.16**	-0.28**
C3: Achieving	0.27**	0.24**	0.53**	0.52**	0.30**	0.19**	0.25**	-0.28**	0.05*	0.32**	0.57**	0.28**	0.84**	0.59**	-0.27**	-0.44**	-0.40**	-0.44**
C4: Proactive	0.25**	0.24**	0.52**	0.50**	0.27**	0.16**	0.18**	-0.25**	-0.08**	0.28**	0.56**	0.31**	0.62**	0.85**	-0.34**	-0.49**	-0.47**	-0.52**
S1: Relaxed	0.31**	0.25**	0.36**	0.20**	0.36**	0.07**	0.12**	-0.35**	-0.02	0.33**	0.43**	0.00	0.23**	0.36**	-0.80**	-0.69**	-0.59**	-0.69**
S2: Contented	0.38**	0.32**	0.39**	0.27**	0.40**	0.15**	0.16**	-0.43**	-0.01	0.31**	0.45**	0.07**	0.31**	0.42**	-0.63**	-0.87**	-0.58**	-0.65**
S3: Self-Assured	0.52**	0.42**	0.61**	0.36**	0.32**	0.01	0.14**	-0.46**	-0.00	0.41**	0.41**	0.07**	0.35**	0.39**	-0.52**	-0.62**	-0.76**	-0.53**
S4: Resilient	0.22**	0.23**	0.45**	0.34**	0.29**	0.10**	0.15**	-0.29**	-0.011	0.398**	0.51**	0.10**	0.39**	0.47**	-0.56**	-0.68**	-0.60**	-0.86**

Note. \*\* Correlation is significant at the 0.01 level (2-tailed). \* Correlation is significant at the 0.05 level (2-tailed).

## Criterion-related validity

Table 8 shows the correlations between B5PQ scale scores and job appraisal ratings. This is based on a sample of respondents who completed B5PQ on the Internet. Respondents were asked to report how their manager assessed their performance at their last performance appraisal using a 4-point scale (excellent, good, satisfactory, poor) and to assess their own performance. Two hundred and seven respondents provided this information. Combined ratings shown in the table are based on correlations between scale scores and the sum of the manager's assessment and the test taker's self-assessment.

At the Big Five level, there are statistically significant correlations across the three categories of rating at around 0.4 between job performance and three of the Big Five; Extraversion, Emotional Stability and Conscientiousness. In the self-assessed and combined ratings, Agreeableness correlates significantly with job performance at about 0.2.

At the primary scale level, 16 out of 20 scales correlate significantly with self-assessed job performance. The median correlation is 0.28. The strongest correlations at around 0.40 are in the Conscientiousness factor – Competent and Achieving. Fourteen scales correlate significantly with reported managerially assessed job performance – the highest correlation is at 0.34 with the Self-Assured scale. The median correlation is 0.23. The strength of correlations between scales and the combined ratings are in between the self-assessed ratings and the managerially assessed ratings as correlations with self-assessed ratings are generally slightly stronger. The median correlation is 0.27.

The range of correlations is consistent with those reported in the literature, for example, Robertson (1997) notes that even with meta-analytic corrections, the upper limits for the validity of personality variables against overall work performance variables are in the range of 0.25 to 0.4.

Regression analysis was used to help understand the contribution of the different B5PQ Big Five scales on job appraisal ratings. A standard multiple regression was performed between managerially and self-assessed job performance combined as the dependent variable and the B5PQ Big Five scales as the independent variables. Table 9 displays the correlations between the variables, the unstandardised regression coefficients (B), the semi-partial correlations ( $sr^2$ ) and R,  $R^2$  and adjusted  $R^2$ .

For the combined ratings, R for regression was significantly different from zero,  $F(5, 201) = 10.75, p < 0.001$ . Altogether, 21% of the variability in job performance ratings was accounted for by the B5PQ Big Five scale scores. Conscientiousness and Extraversion contributed significantly to the combined job performance assessment and accounted for approximately 5.5% of the variability in job performance. The five scales in combination contributed another 15.5% in shared variability.

Exploratory regression analysis with the primary scales as the independent variables indicated that four scales were the best predictors of job performance – Outgoing, Innovative, Competent and Self-Assured.

**Table 8.** Correlations between B5PQ scores and job appraisal ratings (N = 207)

Scale	Self-Assessment	Managerial Assessment	Combined
Extraversion	0.35**	0.35**	0.39**
Agreeableness	0.21**	0.08	0.16*
Openness to Change	0.09	0.06	0.09
Conscientiousness	0.39**	0.29**	0.39**
Emotional Stability	0.36**	0.30**	0.38**
E1: Friendly	0.30**	0.28**	0.33**
E2: Outgoing	0.21**	0.30**	0.28**
E3: Assertive	0.29**	0.28**	0.33**
E4: Energetic	0.31**	0.23**	0.30**
A1: Trusting	0.21**	0.25**	0.26**
A2: Genuine	0.07	-0.06	0.01
A3: Considerate	0.28**	0.16*	0.25**
A4: Unassuming	-0.03	-0.16*	-0.11
O1: Imaginative	-0.22**	-0.06	-0.16*
O2: Innovative	0.27**	0.11	0.22**
O3: Rule-Breaking	0.02	0.02	0.03
O4: Adaptable	0.20**	0.12	0.18**
C1: Competent	0.43**	0.32**	0.42**
C2: Organised	0.09	0.10	0.11
C3: Achieving	0.40**	0.29**	0.39**
C4: Proactive	0.37**	0.27**	0.36**
S1: Relaxed	0.24**	0.21**	0.25**
S2: Contented	0.37**	0.25**	0.35**
S3: Self-Assured	0.31**	0.34**	0.36**
S4: Resilient	0.35**	0.24**	0.33**

Note. \*\* Correlation is significant at the 0.01 level (2-tailed). \* Correlation is significant at the 0.05 level (2-tailed).

**Table 9.** Regression of B5PQ scale sten scores on job performance ratings (N = 207)

	Combined Assessment	Extraversion	Emotional Stability	Conscientiousness	Agreeableness	Openness	B	Beta	Sig.	Unique
Extraversion	0.39						0.05	0.22	0.01	2.39%
Emotional Stability	0.38	0.67					0.03	0.13	0.15	0.83%
Conscientiousness	0.39	0.51	0.56				0.05	0.22	0.01	3.14%
Agreeableness	0.16	0.33	0.38	0.33			-0.01	-0.04	0.62	0.10%
Openness	0.09	0.30	0.26	0.16	-0.08		-0.01	-0.05	0.46	0.21%
Mean	6.23	21.67	21.46	22.49	22.12	20.58			R <sup>2</sup> =	0.21**
Standard Deviation	1.39	6.02	6.69	6.57	4.81	4.87			Adj R <sup>2</sup> =	0.19**
									R=	0.46**

## Norms

The general population norm group is based on an international sample of 25,000 respondents with equal numbers of men and women.

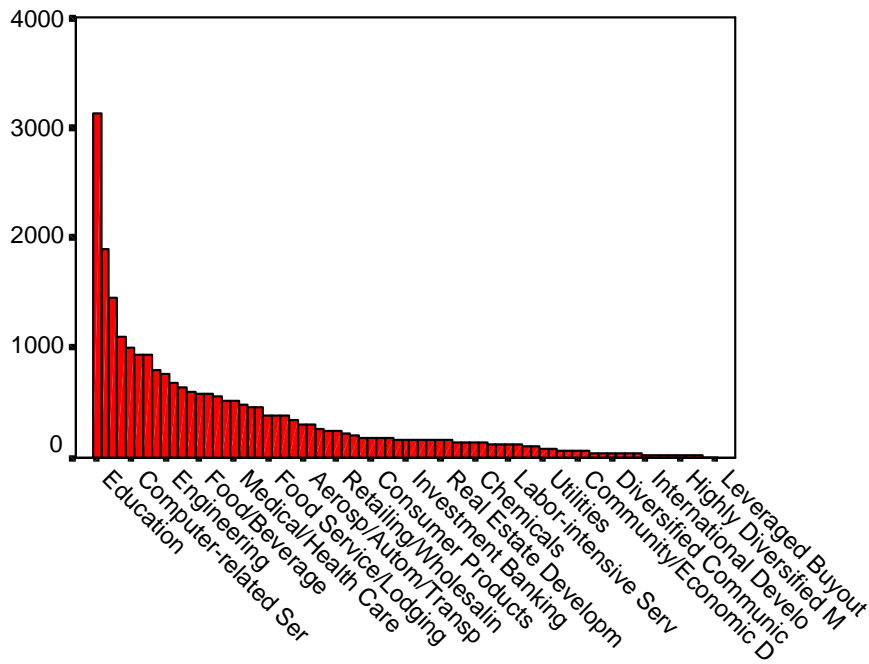
The mean age of the total sample was 30 with a Standard Deviation of 11. The mean ages of men and women in the sample were similar: the mean age of men was 31 with a Standard Deviation of 10, and the mean age of women was 30 with a Standard Deviation of 11 (see Figure 2).

The age characteristics of the B5PQ general population sample are very similar to the age characteristics for the OPQ32n (SHL, 1999) general population sample. The OPQ32n sample mean age is 31 with a Standard Deviation of 13.

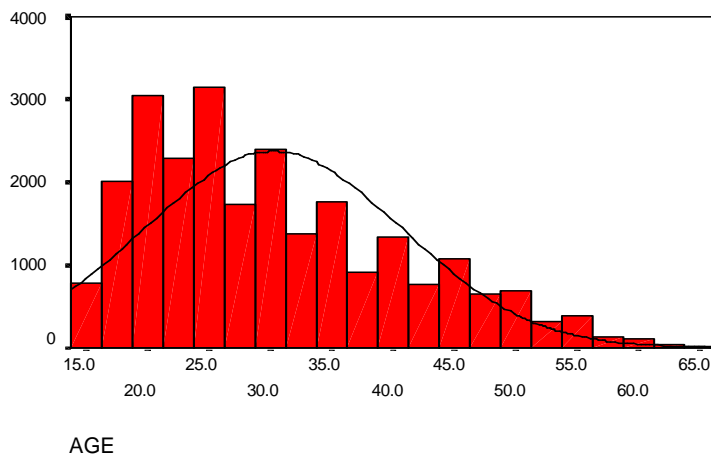
Figure 1 shows the numbers of respondents in the sample by industry sector. Table 10 demonstrates that the general population norm group covers a wide range of industry sectors.

The B5PQ norms are presented in Table 11.

**Figure 1.** Number of respondents by industry sector in B5PQ general population norm sample



**Figure 2.** Number of respondents by age in B5PQ general population norm sample



**Table 10.** Industry sectors in B5PQ general population norm sample

Sector*	Frequency	Percent
Education	589	14.15
Computers/Software	245	5.89
Other Services	233	5.60
Advertising/Marketing	209	5.02
Consulting	189	4.54
Health Services	176	4.23
Arts/Culture	173	4.16
Computer-Related Services	166	3.99
Engineering	147	3.53
Government	140	3.36
Accounting	119	2.86
Sales & Amp	106	2.55
Telecommunications	93	2.23
Other Non-Profit	92	2.21
Other Manufacturing	75	1.80
Entertainment/Leisure	74	1.78
Social Services	67	1.61
Retail/Wholesale & Amp	62	1.49
Internet Development Services	55	1.32
Food/Beverage	50	1.20
Medical/Health Care Devices	49	1.18
Construction	48	1.15
Legal Services	47	1.13
Aerosp/Autom/Transp Equipment	43	1.03
Transportation	41	0.99
Food Service/Lodging	40	0.96
Diversified Financial Svcs/Insurance	39	0.94
Multimedia	39	0.94
Other Communications	38	0.91
Biotechnology	38	0.91
Retailing/Wholesaling	37	0.89
Commercial Banking	36	0.86
Chemicals	33	0.79
Pharmaceuticals	31	0.74
Military	30	0.72
High Technology/Electronics	29	0.70
Computers/Hardware	29	0.70
Energy/Extractive Minerals	28	0.67
Public Relations	27	0.65
Consumer Products	25	0.60
Chemical/Pharm/Medical Products	25	0.60
Sports	24	0.58
Broadcasting	24	0.58
Real Estate Development	24	0.58

\* With more than 0.05% of sample

**Table 11.** B5PQ general population norms (N = 25,000)

Scale	1	2	3	4	5	6	7	8	9	10	Mean	SD
BF1: Extraversion	0-38	39-49	50-60	61-69	70-78	79-87	88-95	96-102	103-108	109-119	77.10	17.64
BF2: Agreeableness	0-52	53-61	62-67	68-74	75-81	82-87	88-93	94-98	99-104	105-114	79.93	12.89
BF3: Openness to Change	0-47	48-54	55-60	61-66	67-73	74-80	81-87	88-94	95-102	103-117	73.21	13.53
BF4: Conscientiousness	0-48	49-58	59-68	69-78	79-88	89-97	98-105	106-111	112-117	118-125	86.47	17.81
BF5: Emotional Stability	0-31	32-44	45-57	58-69	70-81	82-92	93-101	102-109	110-116	117-126	78.93	21.64
E1: Friendly	0-7	8-11	12-15	16-18	19-21	22-25	26-27	28-30	31	32	20.94	6.12
E2: Outgoing	0-6	7-9	10-12	13-15	16-18	19-21	22-24	25-26	27-28	29-31	17.75	5.78
E3: Assertive	0-7	8-10	11-14	15-17	18-19	20-22	23-24	25-26	27-28	29-32	18.86	5.20
E4: Energetic	0-10	11-12	13-15	16-17	18-20	21-22	23-24	25-26	27-28	29-31	19.55	4.74
A1: Trusting	0-7	8-11	12-15	16-18	19-21	22-23	24-25	26-28	29-30	31-32	20.08	5.57
A2: Genuine	0-12	13-15	16-17	18-20	21-22	23-24	25-26	27-28	29-30	31-32	21.74	4.55
A3: Considerate	0-12	13-15	16-18	19-20	21-23	24-25	26-27	28	29-30	31-32	22.19	4.50
A4: Unassuming	0-6	7-8	9-11	12-14	15-16	17-18	19-21	22-23	24-26	27-31	15.91	4.98
O1: Imaginative	0-10	11-13	14-15	16-17	18-19	20-21	22-24	25-26	27-28	29-32	19.14	4.41
O2: Innovative	0-10	11-12	13-15	16-17	18-20	21-23	24-25	26-28	29-30	31-32	20.09	5.14
O3: Rule-Breaking	0-5	6-7	8-9	10-12	13-14	15-16	17-19	20-21	22-24	25-30	13.94	4.68
O4: Adaptable	0-9	10-12	13-15	16-18	19-20	21-23	24-25	26-27	28-29	30-32	20.04	4.94
C1: Competent	0-12	13-15	16-18	19-21	22-23	24-25	26-27	28-29	30	31-32	22.58	4.68
C2: Organised	0-10	11-13	14-16	17-18	19-21	22-24	25-26	27-28	29-30	31-32	20.79	5.10
C3: Achieving	0-10	11-14	15-17	18-21	22-24	25-27	28-29	30	31	32	23.05	5.60
C4: Proactive	0-8	9-11	12-14	15-17	18-21	22-23	24-26	27-28	29-30	31-32	20.05	5.69
S1: Relaxed	0-5	6-8	9-12	13-16	17-19	20-22	23-24	25-27	28-29	30-32	18.25	5.98
S2: Contented	0-6	7-10	11-14	15-18	19-22	23-25	26-28	29-30	31	32	21.01	6.74
S3: Self-Assured	0-6	7-10	11-13	14-17	18-20	21-23	24-25	26-28	29-30	31-32	19.40	5.94
S4: Resilient	0-8	9-11	12-14	15-17	18-21	22-24	25-26	27-29	30-31	32	20.28	5.86
IM: Impression Management	0-29	30-34	35-39	40-45	46-50	51-55	56-60	61-65	66-69	70-80	49.74	10.27

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