NEETHLING BRAIN INSTRUMENTS™

UPDATED RESEARCH REPORT :

Validity and reliability of the Neethling Brain Instrument (NBI)

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INTRODUCTION

This study was commissioned by the author of the NBI in order to update existing research information on the NBI and investigate the reliability and validity of the scale. It will be updated at regular intervals. The analyses are based on three data sets, the largest of which consisted of 1588 administrations of the instrument in a variety of settings in South Africa, including schools, insurance companies, mining houses, etc. This set was primarily used for the analysis of internal consistency of the scales and construct validity estimates. The second set consisted of 37 cases, each tested twice with the instrument in order to establish test-retest reliability. The third set consisted of 133 applications of both the NBI and the Myers Briggs Type Indicator and was analysed to investigate convergent validity.

The ipsative nature of the NBI (the fact that all scores add up to the same total) makes it unsuitable for some traditional measures of reliability and validity, such as internal consistency measures of the total scale or exploratory factor analysis.) However, some analyses can be done to investigate the psychometric properties of the scale.

These include:

- **Test-retest reliability of the subscales**
- **Criterion related validity : If the scale correlates in the theoretically expected directions with proven measures of similar attributes**
- **Internal consistency of the four subscales (i.e. the 4-point ordinal scale is treated as a small continuous scale in order to calculate item-total correlations and Alpha coefficients.) This cannot be done for the whole scale, since there is no variance in the total score. Strictly speaking, this is a violation of the assumptions regarding the nature of the data, but it is done to explore the nature of the intercorrelations between items.**
- **Discriminant validity: If the scale discriminates between groups it is theoretically and intuitively expected to discriminate between, this serves as support for the construct validity of the scale.**

Test-retest reliability

The data sets for this analysis consisted of 37 records, administered to the teachers of a primary school in an urban area. The time lapse between the administrations was 8 months. (Please note : a further set of test-retest data is currently being captured and results will be added as soon as it is available).

The test-retest reliability coefficients for the scales were as follows:

L1 0,851 L2
0,840 R1
0,867 R2
0,918

These are well within acceptable limits for this type of measure.

Criterion-related validity

Theoretically, the scores of the NBI and the MBTI are expected to correlate in the following ways.

One would expect individuals with a strong L1 preference on the NBI to be stronger on sensation (S) than intuition (N), stronger on thinking (T) than on feeling (F) and, more inclined to use judgement (J) than perception (P). On E / I, no specific direction can be predicted, although one might expect a slightly higher correlation with introversion (I) than extraversion. The L2 quadrant can be expected to correlate in much the same directions with the MBTI scales, except that one would expect a slightly stronger correlation with S and J than in the case of L1. As for the R1 quadrant, the expectations would be that it would correlate positively with Intuition (N) rather than Sensation (S) and with Perception (P) rather than Judgement (J). There can be no clear expectation in terms of Thinking and Feeling (F), and one might expect a slightly higher correlation with Entraversion (E) than Introversion. Lastly, R2 scores my be expected to correlate positively with Feeling (F) , rather than Thinking (T). They may also be moderately more inclined to use Perception (P) rather than judgement. No clear expectations can be formulated in the case of the other two MBTI scales.

The manual of the MBTI recommends another type of calculation for research purposes. The preference scores are transformed to a so-called continuous score, by subtracting the scores for E, S, T and J from 100, and adding 100 to the I, N, F and P scores. When these continuous scores are correlated with scale scores from other instruments, negative correlations indicate a correlation between the other measures and E, S, T or J, while positive correlations indicate a correlation between the other measures and I, N, F or P. This transformation makes no change to the correlations however.

These expectations are summarized in the table below, together with the findings obtained so far. The data set for the first analysis consisted of 133 records, administered over a period of approximately one year in a private psychological practice in an urban area. A second application of these two instruments were obtained from a group of trainee specialist police force members (N=49). Results for these 2 data sets, as well as the combined data set (N=-182) are reported below.

				MBTI Scales					
NBI		**E**	**I**	**S**	**N**	**T**	**F**	**J**	**P**
L1	**Expected**	**Slightly negative**	**Slightly positive**	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
	Data 1	**-0.282**	**0.268**	**0.474**	**-0.463**	**0.470**	**-0.478**	**0.487**	**-0.475**
	Data 2	**-0.02**	**-0.05**	**0.28**	**-0.20**	**0.25**	**-0.11**	**0.08**	**-0.13**
	Combined	**-0.22**	**0.20**	**0.44**	**-0.44**	**0.47**	**-0.45**	**0.39**	**-0.39**
L2	**Expected**	**---**	**---**	**Strong Positive**	**Strong Negative**	**Positive**	**Negative**	**Positive**	**Negative**
	Data 1	**-0.222**	**0.198**	**0.695**	**-0.617**	**0.285**	**-0.223**	**0.700**	**-0.688**
	Data 2	**-0.02**	**0.00**	**0.22**	**-0.29**	**0.06**	**-0.10**	**0.66**	**-0.62**
	Combined	**-0.18**	**0.16**	**0.62**	**-0.57**	**0.26**	**-0.21**	**0.68**	**-0.67**
R2	**Expected**	**---**	**---**	**---**	**---**	**Strong Negative**	**Strong Positive**	**Slightly Negative**	**Slightly Positive**
	Data 1	**0.138**	**-0.164**	**-0.226**	**0.157**	**-0.575**	**0.578**	**-0.288**	**0.267**

	Data 2	0.10	-0.02	-0.11	0.12	-0.47	0.19	-0.22	0.23
	Combined	0.12	-0.13	-0.20	0.17	-0.58	0.53	-0.26	0.25
R1	Expected	Slightly positive	Slightly negative	Negative	Positive	---	---	Negative	Positive
	Data 1	0.251	-0.199	-0.699	0.686	-0.096	0.049	-0.669	0.669
	Data 2	-0.06	0.07	-0.38	0.34	0.36	-0.05	-0.49	0.49
	Combined	0.20	-0.16	-0.66	0.64	-0.05	0.04	-0.62	0.62

The theoretical expectations were all fulfilled in the predicted directions. Statistically significant correlations were mostly obtained in the first data set. In the second data set, correlations were somewhat lower, possibly due to the homogenous nature of the group and resultant low variance in scores. Some string correlations were however also obtained as can be seen from the table above and these were all in the expected directions.

Internal consistency

As stated in the introductory remarks, internal consistency measures can at best be performed on the scales individually and not on the total scale, and even doing so will amount to treating the scores as falling on interval scale in stead of ordinal. Nevertheless, this analysis gives a suitable indication of the correlation of the rank of item options with its own scale total in comparison with its correlation with the remaining three scale totals.

See Appendix A

It is clear from Appendix A that the majority of options show clear positive correlations within an acceptable range (>0,20) with the scale total with which it is associated, and corresponding low or negative correlations with the other scales.

Exceptions (where the item-total correlations are < 0,20) are:

Q29AL1	.13	-.02	-.06	-.06
Q29CL2	-.11	-.04	.18	-.08
Q16DL1	.17	.09	-.05	-.17
Q16BL2	.10	.17	-.12	-.04
Q16CR2	-.13	-.17	.19	.10
Q16AR1	-.14	-.07	-.01	.11
Q27CL2	.11	.18	-.15	-.13
Q5BL1	.17	.10	-.10	-.16

There are also isolated instances where an option has a fairly strong positive correlation with two scales, where independence of the scales cannot be assumed, such as the following examples:

Q20AL1	.44	.33	-.28	-.38
Q12AL1	.35	.28	-.24	-.28
Q14AL1	.32	.29	-.23	-.30

(The items which were problematic has since been replaced ; analyses of the performance of these new items will be reported in subsequent research.)

In line with the arguments above, alpha coefficients for the 4 scales were computed separately.

The values were as follows:
L1: 0,6812
L2: 0,7459 R1: 0,8209 R2: 0,7734

These values are within acceptable limits, especially given the small range of the scale from which they were computed.

Discriminant validity

If scores on a scale sufficiently differentiates between subgroups in accordance with what may be expected theoretically, this serves as supportive evidence for the construct validity of the scale. In the first data set (N=1586), two measurements of other variables were recorded in the majority of cases, namely gender (N = 1376) and occupation (N=1206).

It is emphasized that the statistics represented in this section serves as *supportive* and not conclusive evidence for the construct validity of the scale.

Gender

Descriptive statistics with regard to the 4 scale totals of males and females respectively are presented below.

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
L1	Male	734	78.13	9.91	.37
	Female	642	76.50	9.99	.39
L2	Male	734	71.25	10.75	.40
	Female	642	73.33	10.26	.40
R2	Male	733	69.31	11.64	.43
	Female	642	72.84	10.94	.43
R1	Male	733	81.36	13.72	.51
	Female	642	77.62	13.33	.53

The results of a t-test investigating the significance of the differences between the scores of males and females are presented below.

	t	df	Sig. (2-tailed)	Mean Difference	Std. Error of Difference
L1	3.039*	1374	.002	1.63	.54
L2	-3.664	1374	.000	-2.08	.57
R2	-5.775	1373	.000	-3.53	.61
R1	5.112	1373	.000	3.74	.73

(*F-tests showed that the assumption of equal variances can be made)

As can be seen, there are significant differences between males and females on all four scales. The direction of the differences seems to support the traditional and somewhat stereotypical brain profile of males and females respectively. Males scores significantly higher on L1 and R1, which are the quadrants associated with more conceptual, analytical and strategic thinking. Females scored higher on the more perceptual quadrants, namely R2 and L2, representing more meticulous attention to detail and a greater emotional sensitivity.

Specialised Law Enforcement Unit vs. General Population

The scores obtained in the data set where the MBTI was administered, gathered from the general population, was compared with those obtained from the Specialised Law Enforcement Unit. This was done both for the MBTI and the NBI. Results are reported below.

Descriptive Statistics[a]

	SOURCE					
	General population			Law Enforcement Officers		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
E	135	13.39	6.022	47	13.51	5.819
I	135	12.67	6.409	47	12.68	5.898
S	135	15.44	7.437	47	16.09	5.441
N	135	10.29	5.385	47	8.66	3.697
T	135	15.70	6.447	47	20.81	4.776
F	135	7.24	3.978	47	4.09	3.387
J	135	18.44	6.575	47	18.62	6.177
P	135	9.52	6.897	47	8.70	6.341
L1	135	79.39	10.524	47	84.60	6.586
L2	135	75.60	11.095	47	77.60	7.436
R2	135	70.53	11.909	47	64.23	9.053
R1	135	74.34	14.295	47	73.55	7.052
Valid N (listwise)	135			47		

a. No statistics are computed for one or more split files because thre are no valid cases.

Results on most scales are in the expected directions. The Specialized Law enforcement Unit obtained higher scores than the general population on S, and lower scores on N. A larger difference may have been expected on J. The Law Enforcement Unit was also much more Thinking orientated and less Feeling orientated compared to the general population group. They obtained higher scores on L1 and L2 compared to the general population, but much lower scores on R2. With regard to R1 the difference was negligible. These findings contribute to evidence of discriminant validity as an element of construct validity.

Occupation

In terms of occupation, respondents indicated their occupation with varying degrees of accuracy of description. Occupations were initially coded in terms of 39 occupational categories, such as teacher, clerk, or engineer. The initial frequencies of occupations in these categories are indicated Appendix B in order to give a descriptive indication of the spread of occupational fields in the sample.

For purposes of meaningful interpretation, occupational categories were merged further on the basis of similarity in the core skills it involves, as well as in accordance with theoretical expectations of occupations which would require similar thinking styles. In this way, the initial 39 categories were reduced to seven: These newly formed categories and the frequencies in each are presented below:

Categories	Frequency	Valid Percent
1Administrative/ Control	233	19.7
2Analytical/ scientific	204	17.2
3 Human contact	282	23.8
4Management/ Strategic	124	10.5
5 Art / Writing	51	4.3
6 Marketing	234	19.7
7 Practical	57	4.8
Subtotal	1185	100.0
Missing	403	
Total	1588	

Explanation of codes and categories:

1. **Administrative / control combines all the clerical and administrative occupations as well as occupations where detail and control is important, such as credit control.**

2. **Analytical, scientific: Occupations in the financial, medical, and engineering fields were included here.**

3. **Human contact is the term used to describe teaching, training, HR, PRO and customer services as well as the helping professions.**

4. **Management / Strategic include all occupations where management skills and strategic planning are of the essence, such as MD, development managers and Town Planners**

5. **Art / Writing: This category includes occupations where artistic or creative skills are important, such as photographer, graphic designer, and journalist.**

6. **Marketing - all marketing and sales-related occupations fall in this category. In this particular sample, the majority of these were insurance brokers**

7. **Practical : A small subset of the sample were employed in more practical fields, such as fitter and turner, shift boss, foreman or forestry.**

There will, of course, be overlap between these categories in terms of the combination of skills required for each. The above is merely an attempt to isolate the most probable dominant aspects of the occupations for the purpose of analysis.

Lastly, a dichotomous variable was created to distinguish between *management* and *non-management* posts, where this distinction was clear in the information received from respondents.

Theoretical expectations

Every occupation demands certain key skills of employees. It is acknowledged that the assumption cannot be made that individuals are necessarily currently employed in the field where their dominant thinking style is the preferred modus operandi. However, it is assumed that a substantial proportion of the sample chose the occupations they have because of an interest, or have, in time, moved to positions where they are more effective.

At this stage, a further grouping of scores was performed on theoretical grounds. The underlying theory supports the concept of hemispheric thinking, where there are differences between left and right brain thinking *per se* (irrespective of the specific quadrant) as well as between processes in the front and back of the brain respectively. Four new totals were thus added to the existing quadrant scores, namely Right (R), Left (L), Front (F) and Back (B), representing the four regions as described above. The mean scores and standard deviations on these four scales, as well as the original four, for each occupational category are presented in Appendix C.

A one-way analysis of variance was performed with the four original scale totals as dependent variables and the occupational categories as independent variable. The purpose of this analysis was not so much to assess the significance of the overall F-value as an indication of the difference between the 7 means, but to inspect the post hoc Scheffè analysis for the specific differences between means.

These analyses revealed the following significant differences ($p<0.01$):

L1: Administrative / Control (=79.82) and Human Contact (=74.66)
Administrative / Control (=79.82) and Art / Writing (=74.24)
Analytical / Scientific (=79.71) and Human Contact (=74.66)

L2: Administrative / Control (=75.21) and Management / Strategic (=69.39)
Administrative / Control (=75.21) and Art / Writing (=69.43) Administrative / Control (=75.21) and Marketing (=71.05) Management / Strategic (=69.39) and Practical (=76.40)

R2: Analytical / Scientific (=66.67) and Human Contact (=73.64) Human Contact (=73.64) and Management / Strategic (=68.81)
Management / Strategic (=68.81) and Marketing (=69.95)

R1: Administrative / Control (=75.33) and Analytical / Scientific (=81.09)

Administrative / Control (=75.33) and Management / Strategic (=84.95) Administrative / Control (=75.33) and Art / Writing (=85.78) Administrative / Control (=75.33) and Marketing (=81.58) Human Contact (=79.58) and Management / Strategic (=84.95) Management / Strategic (=84.95) and Practical (=74.68) Art / Writing (=85.78) and Practical (=74.68)

The results show that the theoretical and intuitive expectations one might have about the occupational categories, were supported.

Management vs. non-management occupations

The reasoning behind the dichotomy between management and non-management occupations is that management positions would theoretically demand more R1 and L1 (front brain) thinking. The means and standard deviations of these two groups are presented below.

	Management level	N	Mean	Std. Deviation	Std. Error Mean
L1	non-management	976	77.51	10.07	.32
	management	236	77.23	10.29	.67
L2	non-management	976	72.91	10.08	.32
	management	236	70.21	12.06	.79
R2	non-management	975	70.65	11.62	.37
	management	236	69.26	10.71	.70
R1	non-management	975	79.05	13.05	.42
	management	236	83.36	15.10	.98
R	non-management	975	149.69	17.10	.55
	management	236	152.62	19.37	1.26
L	non-management	976	150.42	17.06	.54
	management	236	147.44	19.33	1.25
F	non-management	975	156.56	11.98	.38
	management	236	160.59	12.17	.79
B	non-management	975	143.55	11.96	.38
	management	236	139.47	12.20	.79

A t-test for independent groups was performed to investigate the difference in means between these two groups. The results are presented in the table below:

	t	df	Sig. (2 tailed)	Mean Difference
L1	.375*	1210	.708	0.28
L2	3.554	1210	.000	2.71
R2	1.664	1209	.096	1.38

R1	**_4.41**	**1209**	**.000**	**-4.31**
R	**-2.296**	**1209**	**.022**	**-2.93**
L	**2.344**	**1210**	**.019**	**2.9804**
F	**_4.62**	**1209**	**.000**	**-4.03**
B	**4.691**	**1209**	**.000**	**4.0876**

***Assumption of equal variances could be made**

The table above shows that there were significant differences between subjects in management and non-management positions with regard to the L2 and R1 quadrants, as well as front and back brain thinking styles. Subjects in management positions showed a significantly higher preference for R1 thinking and a significantly lower preference for L2 thinking in comparison with individuals in non-management positions. Individuals in both groups showed a preference for front brain thinking over back brain thinking, but management had significantly higher scores on front brain (conceptual) thinking, while non-management score were higher than management on back brain (perceptual) thinking.

Conclusion

The results presented above seems to give fairly strong support for both the validity and reliability of the NBI. This is a continuous research project this report will be updated as often as possible.

SEE APPENDIX A, B AND C FOR DETAILED RESEARCH DATA

Appendix A

Item-total correlations within scales: NBI

Item	Scales L1	L2	R2	R1
Q1AR1*	-.12	-.22	-.03	.34 #
Q1CR2	-.16	-.17	.25	.11
Q1DL2	.07	.31	-.06	-.17
Q1BL1	.28	.15	-.06	-.20
Q2CR1	-.19	-.33	.09	.39
Q2DR2	-.23	-.15	.27	.03
Q2AL2	.16	.43	-.21	-.34
Q2BL1	.27	.05	-.13	-.06
Q3CR1	-.15	-.33	-.04	.46
Q3AR2	-.21	-.10	.37	-.06
Q3BL2	.21	.48	-.10	-.40
Q3DL1	.21	-.01	-.21	.06
Q4CR1	-.18	-.18	.01	.26
Q4BR2	-.24	-.24	.37	.15
Q4DL2	.15	.27	-.19	-.18
Q4AL1	.32	.20	-.18	-.23
Q5CR1	-.27	-.39	.09	.43
Q5DR2	-.17	-.17	.23	.08
Q5AL2	.26	.46	-.23	-.37
Q5BL1	.17	.10	-.10	-.16
Q6DR1	.02	-.09	-.15	.17
Q6CR2	-.30	-.20	.38	.14
Q6BL2	-.08	.21	.10	-.16
Q6AL1	.33	.08	-.29	-.13
Q7DR1	-.26	-.39	.10	.49
Q7CR2	-.22	-.11	.37	-.04
Q7BL2	.24	.44	-.21	-.40
Q7AL1	.25	.07	-.23	-.10
Q8BL1	.33	.13	-.27	-.13
Q8AL2	.17	.29	-.23	-.16
Q8CR2	-.31	-.19	.46	.00
Q8DR1	-.15	-.21	.05	.30
Q9DL1	.37	.31	-.18	-.37
Q9BL2	.10	.25	-.11	-.16
Q9CR2	-.28	-.15	.44	.02
Q9AR1	-.13	-.30	-.11	.45
Q10AL1	.22	-.02	-.24	.02
Q10CL2	.04	.27	.02	-.27
Q10BR2	-.25	-.18	.33	.06
Q10DR1	-.04	-.08	-.05	.20
Q11BL1	.34	.15	-.17	-.19
Q11DL2	.07	.27	-.09	-.21
Q11AR2	-.25	-.11	.39	-.03
Q11CR1	-.15	-.30	-.13	.42
Q12AL1	.35	.28	-.24	-.28
Q12CL2	.15	.32	-.14	-.31

Q12DR2	**-.24**	**-.24**	**.31**	**.14**
Q12BR1	**-.24**	**-.32**	**.09**	**.44**
Q13DL1	**.26**	**.06**	**-.11**	**-.06**
Q13CL2	**.19**	**.35**	**-.17**	**-.26**
Q13BR2	**-.11**	**-.07**	**.28**	**-.02**
Q13AR1	**-.28**	**-.28**	**.06**	**.36**
Q14AL1	**.32**	**.29**	**-.23**	**-.30**
Q14BL2	**.13**	**.24**	**-.12**	**-.23**
Q14CR2	**-.27**	**-.18**	**.31**	**.07**
Q14DR1	**-.19**	**-.32**	**.04**	**.41**
Q15CL1	**.27**	**.12**	**-.22**	**-.17**
Q15DL2	**.16**	**.38**	**.01**	**-.35**
Q15BR2	**-.30**	**-.20**	**.34**	**.16**
Q15AR1	**-.08**	**-.25**	**-.13**	**.36**
Q16DL1	**.17**	**.09**	**-.05**	**-.17**
Q16BL2	**.10**	**.17**	**-.12**	**-.04**
Q16CR2	**-.13**	**-.17**	**.19**	**.10**
Q16AR1	**-.14**	**-.07**	**-.01**	**.11**
Q17DL1	**.28**	**.19**	**-.12**	**-.25**
Q17BL2	**.06**	**.24**	**-.09**	**-.15**
Q17CR2	**-.16**	**-.05**	**.31**	**-.13**
Q17AR1	**-.17**	**-.32**	**-.12**	**.44**
Q18BL1	**.36**	**.10**	**-.24**	**-.06**
Q18CL2	**.12**	**.26**	**-.12**	**-.17**
Q18DR2	**-.23**	**-.01**	**.42**	**-.16**
Q18AR1	**-.18**	**-.26**	**-.06**	**.33**
Q19DL1	**.29**	**-.01**	**-.16**	**-.00**
Q19AL2	**.10**	**.21**	**-.11**	**-.06**
Q19CR2	**-.14**	**.03**	**.36**	**-.19**
Q19BR1	**-.17**	**-.12**	**-.03**	**.29**
Q20AL1	**.44**	**.33**	**-.28**	**-.38**
Q20BL2	**-.01**	**.15**	**-.09**	**-.07**
Q20CR2	**-.27**	**-.15**	**.45**	**-.06**
Q20DR1	**-.20**	**-.32**	**-.08**	**.46**
Q21BL1	**.30**	**.27**	**-.17**	**-.27**
Q21CL2	**.18**	**.29**	**-.22**	**-.17**
Q21DR2	**-.22**	**-.14**	**.40**	**-.02**
Q21AR1	**-.21**	**-.34**	**-.00**	**.40**
Q22DR1	**-.22**	**-.35**	**.02**	**.47**
Q22AR2	**-.22**	**-.03**	**.39**	**-.23**
Q22CL2	**.18**	**.41**	**-.13**	**-.26**
Q22BL1	**.29**	**.02**	**-.30**	**-.03**
Q23CR1	**-.10**	**-.28**	**-.09**	**.40**
Q23BR2	**-.18**	**-.10**	**.31**	**-.02**
Q23DL2	**.00**	**.24**	**.01**	**-.23**
Q23AL1	**.29**	**.17**	**-.20**	**-.14**
Q24DR1	**-.18**	**-.29**	**-.06**	**.45**
Q24CR2	**-.28**	**-.06**	**.49**	**-.16**
Q24AL2	**.24**	**.44**	**-.17**	**-.36**
Q24BL1	**.24**	**-.07**	**-.23**	**.05**
Q25DR1	**-.21**	**-.33**	**.03**	**.48**

Q25BR2	**-.10**	**.05**	**.30**	**-.11**
Q25CL2	**.07**	**.30**	**.06**	**-.30**
Q25AL1	**.34**	**.12**	**-.24**	**-.05**
Q26BR1	**-.24**	**-.31**	**.11**	**.40**
Q26CR2	**-.06**	**.07**	**.24**	**-.23**
Q26DL2	**.20**	**.40**	**-.12**	**-.37**
Q26AL1	**.10**	**-.15**	**-.19**	**.21**
Q27DR1	**-.13**	**-.19**	**.01**	**.33**
Q27AR2	**-.13**	**-.07**	**.22**	**-.08**
Q27CL2	**.11**	**.18**	**-.15**	**-.13**
Q27BL1	**.16**	**.11**	**-.11**	**-.17**
Q28AR1	**-.13**	**-.26**	**-.04**	**.37**
Q28DR2	**-.26**	**-.20**	**.30**	**.12**
Q28BL2	**.13**	**.36**	**-.03**	**-.34**
Q28CL1	**.30**	**.16**	**-.19**	**-.17**
Q29AL1	**.13**	**-.02**	**-.06**	**-.06**
Q29BL2	**.09**	**.26**	**-.08**	**-.26**
Q29CL2	**-.11**	**-.04**	**.18**	**-.08**
Q29DR2	**-.13**	**-.20**	**-.05**	**.32**
Q30CL1	**.29**	**.19**	**-.13**	**-.27**
Q30BL2	**.19**	**.27**	**-.21**	**-.19**
Q30DR2	**-.22**	**-.08**	**.31**	**.01**
Q30AR1	**-.20**	**-.30**	**.06**	**.39**

*** Notation: Q1AR1 : Question 1, option a, scale R1 #**
Highest correlation with scale total is highlighted N=1580
(Casewise deletion of missing data)

Appendix B

Occupation	Valid Frequency	Percent
Administrative / clerical	119	9.9
Financial	50	4.1
Marketing	234	19.4
Management (undefined)	61	5.1
Education / Training	126	10.4
Social worker / helping professions	38	3.2
Journalist / Publishing	32	2.7
Bank manager	10	.8
Arts e.g. graphic artist, Interior design	19	1.6
Medial - hospital management	18	1.5
Agricultural	16	1.3
Library / Information science	61	5.1
Credit controller	40	3.3
Law	6	.5
Geology	11	.9
Shift boss / foreman	41	3.4
Production planning / Logistics	29	2.4
Trade, e.g. fitter & turner	7	.6
Forestry	9	.7
Human resources	37	3.1
Computer	26	2.2
Engineering	36	3.0
PRO / Customer service / Liaison	28	2.3
Pharmacist	27	2.2
Entrepreneur / "businessman"	13	1.1
Psychology	13	1.1
Pastor / Minister	5	.4
Development	10	.8
Managing Director	10	.8
Project management	13	1.1
Quantity surveying	4	.3
Photography	7	.6
Town Planning	1	.1

Occupation	Frequency	Valid Percent
Food service manager	3	.2
Nursing / Nursing management	35	2.9
Occupational therapist	5	.4
Physiotherapist	2	.2
Biokineticist	2	.2
Dietician	1	.1
Subtotal	1206	100.0
Missing	382	
Total	1588	

Appendix C

	L1		L2		R1		R2		Left		Right		Front		Back	
Occu.	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
1	79.82	9.69	75.21	8.74	75.33	11.61	70.05	10.88	152.2	18.20	145.3	15.31	155.1	11.26	145.2	11.05
2	79.71	10.22	72.56	11.44	81.09	13.79	66.67	11.61	146.6	18.78	147.7	18.21	160.8	12.52	139.2	12.53
3	74.66	10.72	71.98	10.78	79.58	14.37	73.64	12.65	146.3	20.51	153.2	18.91	154.2	12.64	145.6	12.66
4	76.96	10.51	69.39	12.43	84.95	15.32	68.81	11.23	143.6	17.57	153.7	20.53	161.9	11.71	138.1	11.65
5	74.24	9.05	69.43	11.80	85.78	13.26	70.57	9.86	148.4	16.41	156.3	17.53	160.0	11.14	140.0	11.14
6	77.42	9.66	71.05	9.77	81.58	12.42	69.95	10.62	155.1	11.63	151.5	16.47	159.0	10.91	140.9	10.90
7	78.79	7.67	76.40	7.78	74.68	10.88	70.86	10.52	149.9	17.71	145.5	12.12	153.4	11.38	147.2	11.71
Total	77.59	10.17	72.37	10.60	80.00	13.62	70.15	11.53	149.9	17.71	150.1	17.76	157.5	12.12	142.5	12.11