LOCUS OF CONTROL INVENTORY

DEVELOPMENT AND STANDARDISATION TECHNICAL SUPPLEMENT

TECHNICAL MANUAL

LOCUS OF CONTROL INVENTORY

DEVELOPED BY PROF. JOHANN M. SCHEPERS

PSYCHOMETRICS

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Acknowledgements

The LCI 5th edition is a revision of the LCI 4th edition developed by Professor Johann M Schepers. The Research Department at JvR is responsible for all changes that were made to the instrument and research done on the instrument. The Technical Manual and all analyses were written and conducted by Brandon Morgan. Users of the LCI 5th edition should reference the instrument as Schepers (2016).

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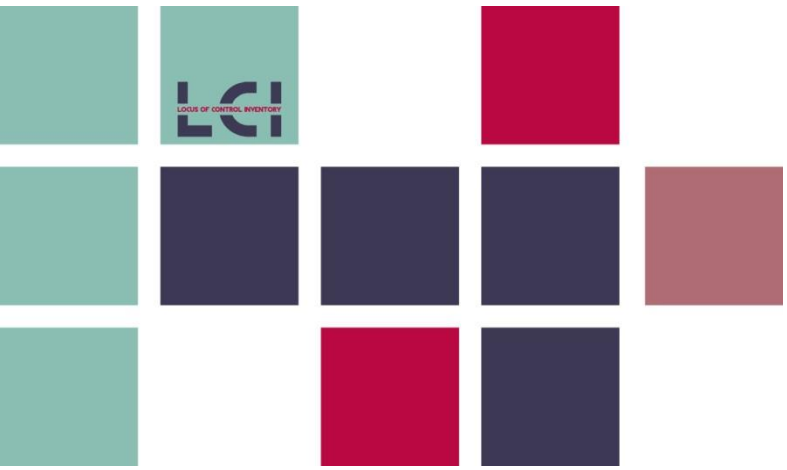


1. Introduction

1.1 Main features / brief overview

The Locus of Control Inventory (LCI) 5th edition is a multidimensional measure of locus of control. It consists of 45 items and takes approximately 15 to 30 minutes to complete. The LCI is an online assessment hosted by JvR Online and is suited for students and adults.

1.2 Purpose and rationale

The LCI is based on attribution theory and Rotter's social learning theory. It consists of three scales: Autonomy, Internal locus of control, and External locus of control. The Gunning Fog index for the LCI 5th edition is 10.3[1]. Further details on the purpose and rationale of the LCI and its theoretical underpinning are provided in the Technical Manual.

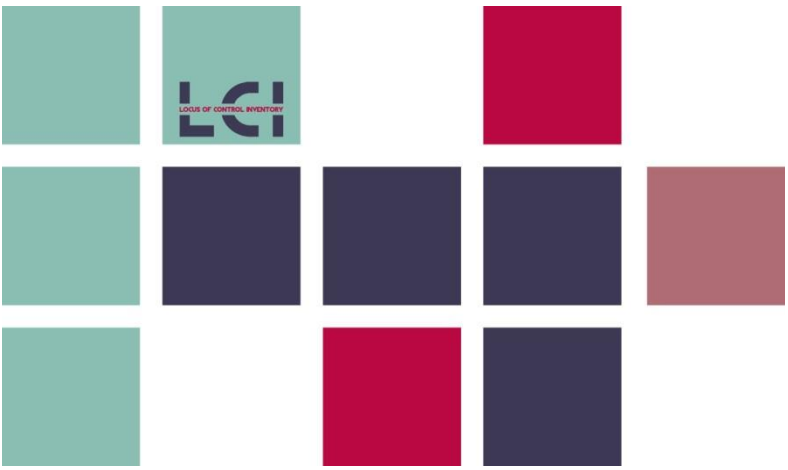
1.3. History of the product

[1] The Gunning Fog index was calculated using the koRpus package in R.

The first version of the LCI was developed in 1994. It was subsequently revised in 1995, 1999, and 2003. The LCI 5th edition is based on the 2003 revision. A detailed exposition of the development of the LCI is provided in the Technical Manual (Schepers, 2013).

1.4 Development of the LCI 5th edition

The LCI 4th edition consists of 88 items across three scales: Autonomy, Internal locus of control, and External locus of control. The three scales have demonstrated mostly satisfactory psychometric properties across a range of studies (Berg, Buys, Olckers, & Schaap, 2004; de Bruin, 2004; Schaap, Buys, & Olckers, 2003; Schepers, 2005, 2007; Schepers, Gropp, & Geldenhuys, 2006). An updated psychometric analysis of the LCI 4th edition items was conducted in 2015 on a sample of 656 working adults to investigate the factor structure, item fit, and differential item functioning across gender and ethnicity (the full report is available as a research supplement). The results mostly mirrored those obtained by the aforementioned authors. However, there was some evidence of potentially problematic items. It was therefore decided to develop a shorter version of the LCI in which potentially problematic items were removed to reduce the total number of items needed for each scale. Potentially problematic items were removed in an iterative fashion based on the psychometric analysis of the LCI until 15 items for each scale remained. First, all items displaying statistically significant differential item functioning across gender and ethnicity were removed. Hereafter items that displayed non-significant unstandardised factor loadings, small standardised factor loadings, and/or low communality values were removed. Lastly, items that shared similar item content and demonstrated correlated residuals were removed.



2. Interpreting and use of the results

Rotter defined locus of control as a generalised expectancy concerned with the causal sequence from behaviour to outcome (Pervin & John, 2001; Rotter, 1966). Because locus of control is a general belief about what determines outcomes (Rotter, 1966), it operates over a range of situations (Lefcourt, 1966). The predictive power of locus of control, however, depends upon the novelty of the situation and the degree to which a person relies on specific expectancies, rather than generalised expectancies in determining behaviour and expected outcomes (Coombs & Schroeder, 1988; Rotter, 1975; Wang, Bowling, & Eschleman, 2010). The LCI yields three scores: Autonomy, Internal locus of control, and External locus of control. The three constructs are defined as follows:

2.1 Autonomy

Autonomy is closely related to Internal locus of control. It is defined as "the tendency to attempt to master or be effective in the environment, to impose one's wishes and designs on it" (Wolman, 1973, p. 37). People who score high on Autonomy tend to seek control of situations that offer possibilities of change, readily accept the challenge of solving complex problems, take the initiative in situations requiring leadership, prefer to work on their own, and choose to structure their own work programme. People who score low on Autonomy may feel uncomfortable when change occurs and may prefer having others take initiative in situations requiring leadership. They may also prefer structured environments where change does not readily occur.

2.2 Internal locus of control

Internal locus of control is a person's belief that an outcome "is contingent on their own behavior or personal characteristics" (Rotter, 1966, p. 56). People who score high on Internal locus of control are convinced that the reinforcement of their behaviour depends on their own achievements, abilities, dedication and perseverance. Thus the outcome of their behaviour will change the probability of that behaviour occurring again in the specific situation (Rotter, 1966). People who score high on Internal locus of control tend to view their achievement as a result of hard work and dedication, believe that achievement of personal objectives depends on themselves and that reward for achievement is earned, and view the outcome of matters as determined by their own inputs. A high score on Internal locus of control implies that a person's expectation of control is internal. A low score on Internal locus of control implies that a person may not accept achievements as due to his/her hard work and dedication, that reward for achievement is not earned, and that success depends on being at the right place at the right time.

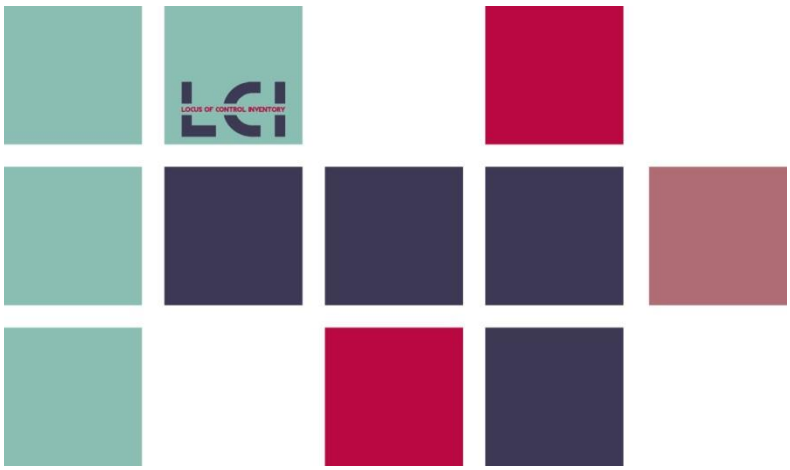
2.3 External locus of control

External locus of control is a person's belief that an outcome is "a function of chance, luck, or fate, is under the control of powerful others, or is simply unpredictable" (Rotter, 1990, p. 56). People who score high on External locus of control tend to believe that random or chance events, luck, or influential people are responsible for their behaviour. In this way, people may believe that they do not have control over outcomes and may not rely on previous experiences when selecting a particular behaviour (Rotter, 1966). People who score high on External locus of control tend to believe that their behaviour is subject to fate and is influenced by coincidences, that present achievements are adversely affected by negative experiences in the past, and that only people who are at the right place at the right time get promoted. A high score on External locus of control implies that a person's expectation of control is external. A low score on External locus

of control implies that a person does not believe that his/her behaviour is subject to the whims of fate, that life is not controlled by coincidence and fate, and that rewards and promotions are earned.

2.4 Association of the basic scores with other measures

The LCI has been correlated with a variety of constructs. These include personality, sense of coherence, and emotional intelligence, among others. Further information on these relationships are provided in the Technical Manual (Schepers, 2013).



3. Norming

Two samples were used for psychometric analysis and norming of the LCI. A total of 1075 respondents were used to obtain the norm scores. In Study 1 the 45 LCI – Short items were analysed based on a subset of the sample group from which the full psychometric analysis was conducted. Respondents were 644 working adults obtained from the JvR database. Two ethnic groups were selected from the pooled database for inclusion in the analysis. These were Black participants (*n* = 371, 58%) and White participants (*n* = 274, 42%). There were insufficient numbers of respondents from the Coloured and Indian/Asian ethnic groups to make analysis of the data feasible. There were more men (*n* = 484, 75%) than women (*n* = 161, 25%) in the sample. The psychometric properties of the 45 items were then re-analysed on a second sample group (Study 2) in order to cross-validate the results.

In Study 2, respondents were 431 working adults obtained from the JvR database who had completed the full version of the LCI. The majority of respondents were from the Black (*n* = 152, 35%) and White (*n* = 124, 29%) ethnic groups. The remainder were from the Indian/Asian (*n* = 16, 4%) and Coloured (*n* = 11, 3%) ethnic groups. One-hundred-and-twenty-eight (30%) of the respondents did not indicate their ethnic group. There were more men (*n* = 277, 64%) than women (*n* = 153, 35%) in the sample. The home language of the respondents were: Afrikaans (*n* = 133, 31%), English (*n* = 91, 21%), Ndebele (*n* = 2, .5%), Pedi (*n* = 42, 10%), Sotho (*n* = 17, 4%), Swazi (*n* = 1, .2%), Tsonga (*n* = 10, 2%), Tswana (*n* = 21, 5%), Venda (*n* = 8, 2%), Xhosa (*n* = 8, 2%), Zulu (*n* = 18, 4%), and not indicated (*n* = 80, 19%).

4. Psychometric properties: Reliability and validity

Any test used in practice needs to demonstrate satisfactory reliability and validity (Salkind, 2011). In the sections that follow evidence of reliability and construct validity for the LCI across the two sample groups are provided.

4.1 Study 1

Descriptive statistics for the three LCI 5th edition scales are presented in Table 1. Histograms and bean plots for the scale scores are provided in Figure 1 to Figure 3. Inspection of these plots indicate that the Autonomy and Internal locus of control scales are negatively skewed (i.e., most people scored higher on these scales) and that the External locus of control scale is positively skewed (i.e., most people score low on this scale).

Table 1: Descriptive Statistics for the Scale Scores: Study 1

Scale	Mean	SD	Median	Skewness	Kurtosis	SE
Autonomy	88.49	8.39	89.00	-0.29	-0.31	0.33
Internal	92.24	7.58	93.00	-0.41	-0.46	0.30
External	42.52	12.85	41.00	0.38	-0.23	0.51

Note. SD = standard deviation, SE = Standard error.

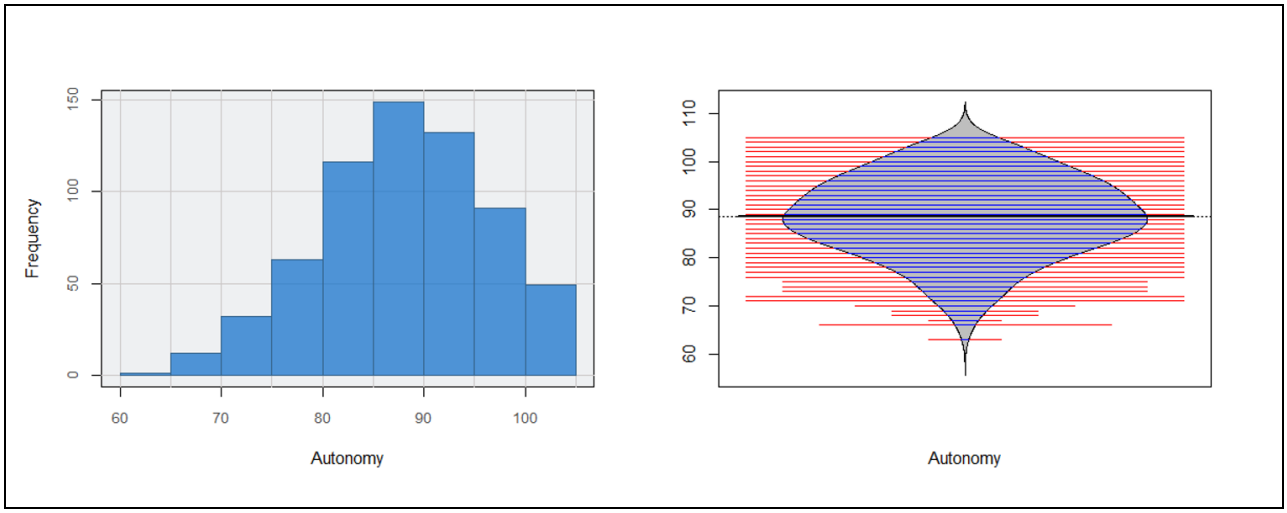


Figure 1: Histogram and beanplot for the Autonomy scale.

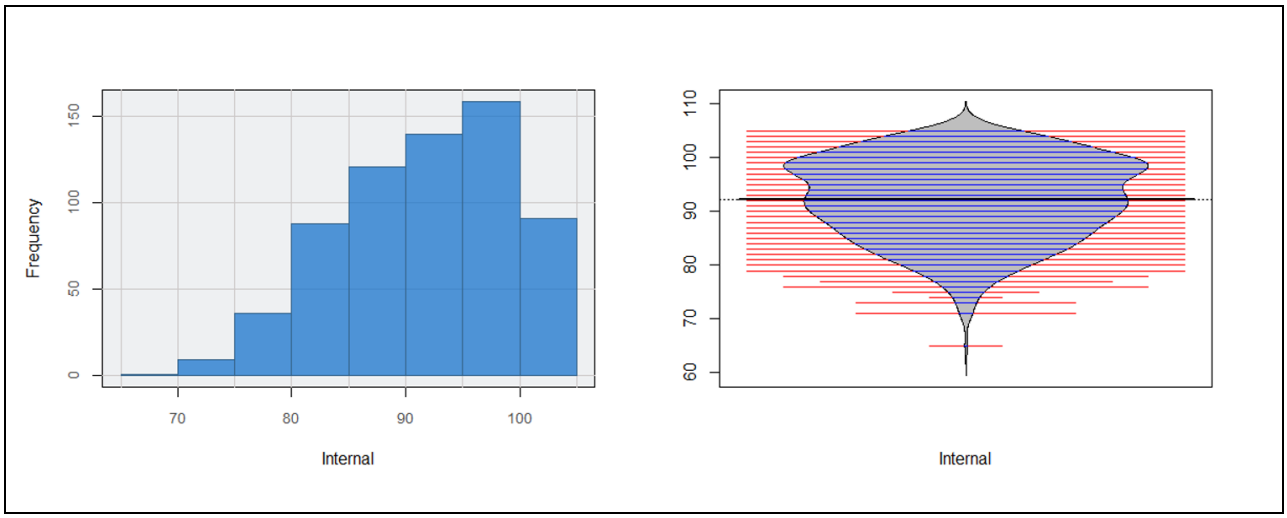


Figure 2: Histogram and beanplot for the Internal locus of control scale.

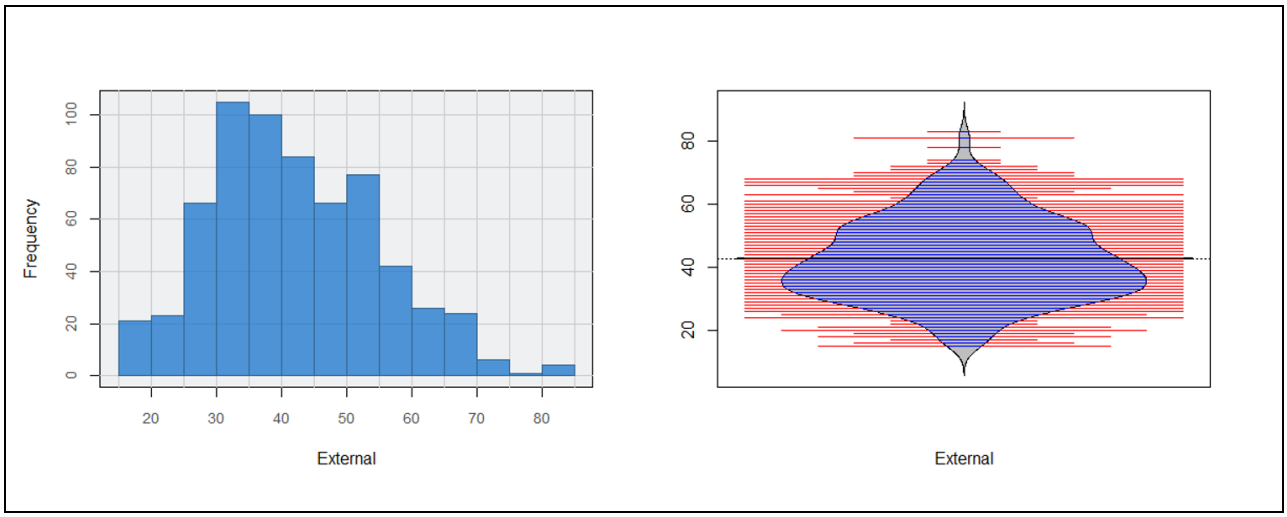


Figure 3. Histogram and beanplot for the External locus of control scale.

4.1.1 Reliability

Reliability coefficients for the LCI 5th edition scales are presented in Table 2. Cronbach alpha coefficients (Cronbach, 1951), Guttman's Lambda 2 (Guttman, 1945), and McDonald's Omega total (McDonald, 1999; Revelle & Zinbarg, 2009) were used as measures of reliability. Item and Person separation reliability estimates from a Rasch analysis[2] are also presented. Item and person reliability indices indicate the extent to which item/person locations can be reproduced (Linacre, 2016a). As a whole the reliability coefficients were all satisfactory.

Table 2: Reliability Coefficients for the Scale Items: Study 1

Scale	α	λ_2	ω	IR	PR
Autonomy	.82 (.79 - .85)	.82	.84	.96	.80
Internal	.76 (.72 - .79)	.76	.77	.93	.70
External	.84 (.82 - .87)	.85	.84	.98.	.82

Note. 95% confidence intervals for α in parentheses. IR = Item separation reliability, PR = Person separation reliability.

[2] All Rasch analyses were conducted using Winsteps (Linacre, 2016b).

Reliability coefficients for gender and ethnicity are provided in Tables 3 to 6. The technique described by Feldt, Woodruff, and Salih (1987) was used to determine if there is a statistically significant difference between the Cronbach alpha coefficients for gender and ethnicity. The results indicated that there was no statistically significant difference in the alpha coefficients for men and women on the Autonomy (p = .09) and Internal locus of control (p = .77) scales and that there was a statistically significant difference on the External locus of control (p = .03) scale.

Table 3: Reliability Coefficients for the Scale Items for Men: Study 1

Scale	α	λ_2	ω	IR	PR
Autonomy	.81 (.78 - .84)	.81	.82	.95	.80
Internal	.76 (.72 - .80)	.76	.77	.89	.71
External	.85 (.82 - .88)	.85	.85	.98	.83

Note. 95% confidence intervals for α in parentheses.

Table 4: Reliability Coefficients for the Scale Items for Women: Study 1

Scale	α	λ_2	ω	IR	PR
Autonomy	.85 (.80 - .90)	.85	.86	.93	.82
Internal	.75 (.68 - .82)	.76	.78	.52	.66
External	.80 (.74 - .86)	.80	.80	.94	.90

Note. 95% confidence intervals for α in parentheses.

For ethnicity there was no statistically significant difference in the alpha coefficients for the Autonomy (p = .36) and Internal locus of control (p = .74) scales while there was a statistically significant difference on the External locus of control (p = .01) scale. However, because in both cases, the reliability coefficients were high for all comparison groups (above .80), this difference

is not seen to have a great impact on the overall interpretation of results on the External locus of control scale across groups.

Table 5: Reliability Coefficients for the Scale Items for Black Respondents: Study 1

Scale	α	O α	λ_2	ω	IR	PR
Autonomy	.81 (.78 - .85)	.89	.82	.83	.92	.78
Internal	.75 (.70 - .80)	.89	.76	.77	.91	.67
External	.82 (.79 - .86)	.85	.83	.83	.97	.80

Note. 95% confidence intervals for α in parentheses.

Table 6: Reliability Coefficients for the Scale Items for White Respondents: Study 1

Scale	α	O α	λ_2	ω	IR	PR
Autonomy	.83 (.79 - .87)	.89	.84	.84	.92	.83
Internal	.76 (.80 - .81)	.88	.77	.78	.83	.74
External	.87 (.84 - .90)	.88	.87	.87	.97	.86

Note. 95% confidence intervals for α in parentheses.

4.1.2 Item Descriptive Statistics

The average inter-item correlation coefficients and item-total correlation coefficients for the LCI 5th edition scale items are presented in Table 7 to Table 9. The item-total correlation coefficient is an estimate of the correlation between the item and the total summated scale score. Positive item-total correlation coefficients indicate that the item is able to discriminate between people who score high and low on the scale (Murphy & Davidshofer, 2005). The average inter-item correlation coefficients and item-total correlation coefficients were positive across all the scales.

Table 7: Item Level Descriptive Statistics for the Autonomy Scale: Study 1

Item	Mean	SD	Average R	R Cor	R Drop
i1A	5.30	1.46	.26	.35	.32
i2A	5.50	1.04	.25	.48	.44
i3A	6.00	1.10	.25	.48	.43
I4A	5.90	.98	.25	.43	.39
i5A	5.50	1.21	.25	.45	.41
i6A	6.10	.98	.24	.57	.51
i7A	6.00	.98	.25	.49	.45
i8A	6.50	.76	.24	.59	.53
i9A	6.00	1.13	.25	.43	.39
i10A	6.50	.82	.25	.41	.37
i11A	5.90	1.08	.25	.42	.38
i12A	6.00	1.05	.24	.59	.53
i13A	5.60	.96	.24	.58	.52
i14A	6.00	.95	.24	.62	.55
i15A	5.80	1.00	.24	.58	.52

Note. Average R = average inter-item correlation, R Cor = item whole correlation corrected for item overlap and scale reliability, R Drop = item whole correlation against the scale without the item.

Table 8: Item Level Descriptive Statistics for the Internal Locus of Control Scale: Study 1

Item	Mean	SD	Average R	R Cor	R Drop
i1I	5.60	1.21	.20	.24	.20
i2I	6.10	1.11	.18	.46	.39
i3I	6.10	1.11	.19	.36	.31
i4I	6.40	.90	.18	.53	.46
i5I	6.20	1.15	.20	.24	.20
i6I	6.30	.98	.18	.51	.45
i7I	6.40	.84	.18	.49	.42
i8I	6.00	1.27	.18	.50	.43
i9I	6.00	1.27	.19	.32	.28
i10I	6.40	.85	.18	.41	.35
i11I	6.00	1.19	.18	.48	.41
i12I	6.00	1.00	.18	.56	.48
i13I	6.10	1.17	.19	.36	.31
i14I	6.50	.70	.18	.53	.46
i15I	6.10	.98	.18	.45	.38

Note. Average R = average inter-item correlation, R Cor = item whole correlation corrected for item overlap and scale reliability, R Drop = item whole correlation against the scale without the item.

Table 9: Item Level Descriptive Statistics for the External Locus of Control Scale: Study 1

Item	Mean	SD	Average R	R Cor	R Drop
i1E	2.90	1.40	.27	.49	.45
i2E	2.70	1.50	.27	.49	.45
i3E	2.60	1.40	.27	.49	.44
i4E	2.70	1.50	.26	.54	.49
i5E	2.30	1.50	.26	.54	.49
i6E	2.20	1.40	.26	.61	.55
i7E	3.10	1.60	.26	.56	.52
i8E	4.00	1.60	.27	.48	.44
i9E	1.90	1.50	.27	.38	.35
i10E	2.20	1.50	.26	.60	.55
i11E	3.20	1.70	.26	.60	.55
i12E	3.60	1.60	.27	.39	.36
i13E	2.80	1.50	.26	.55	.50
i14E	3.20	1.70	.26	.61	.56
i15E	3.10	1.50	.27	.40	.37

Note. Average R = average inter-item correlation, R Cor = item whole correlation corrected for item overlap and scale reliability, R Drop = item whole correlation against the scale without the item.

4.1.3 Rasch analysis combined sample

A Rasch (1960) partial-credit model (Wright & Masters, 1982) analysis was conducted on each scale of the LCI 5th edition. Items with Infit and Outfit mean squares values (IMNSQ and OMNSQ) > 1.40 were considered to be underfitting items, and items with IMNSQ and OMNSQ values < .60 to be overfitting items (Bond & Fox, 2007; Wright, Linacre, Gustafson, & Martin-Lof, 1994). Underfitting items are particularly problematic because they degrade the quality of the scale (Bond & Fox, 2007). OMNSQ investigates unexpected responses to items that are either too easy

or too difficult for the respondent, whereas IMNSQ investigates unexpected responses on items that are targeted at the respondents underlying latent ability measure (Linacre, 2016a). The OMNSQ is sensitive to outliers and therefore IMNSQ is a better indicator of item misfit (Bond & Fox, 2007).

4.1.3.1 Autonomy

Item locations and fit statistics for the Autonomy scale are provided in Table 10. The item locations ranged from -.43 to .51 logits. One item demonstrated underfit using the Outfit MNSQ, but not using the Infit MNSQ.

Table 10: Autonomy Item Location and Item Fit Statistics: Study 1

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.51	.04	1.37	5.5	**1.64**	8.6	.45	.57
i2A	.10	.05	1.04	.7	1.09	1.5	.52	.55
i3A	-.08	.04	1.01	.2	1.11	1.4	.47	.47
I4A	.11	.05	1.07	1.0	1.16	2.4	.45	.50
i5A	.22	.04	1.14	2.1	1.28	4.1	.49	.55
i6A	-.27	.05	.89	-1.5	.87	-1.8	.51	.46
i7A	-.17	.05	.97	-.3	.96	-.5	.51	.48
i8A	-.41	.06	.81	-1.9	.75	-2.9	.50	.38
i9A	.06	.04	1.08	1.0	1.28	3.4	.45	.48
i10A	-.43	.05	.99	.0	1.00	.0	.39	.37
i11A	.04	.04	1.08	1.0	1.26	3.3	.45	.48
i12A	.11	.04	.87	-1.8	.87	-1.9	.54	.47
i13A	.10	.05	.93	-1.2	.93	-1.2	.57	.54
i14A	.00	.05	.85	-1.8	.87	-1.9	.56	.48
i15A	.11	.05	.90	-1.2	.94	-.8	.55	.51
Mean	.00	.05	1.00	.1	1.07	.9		
SD	.24	.01	.14	1.9	.22	3.0		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold. Measure is the item location estimate (this applies to all Rasch output Tables).

4.1.3.2 Internal Locus of Control

Item locations and fit statistics for the Internal locus of control scale are provided in Table 11. The item locations ranged from -.31 to .25 logits. Four items demonstrated underfit using the Outfit MNSQ, but not using the Infit MNSQ.

Table 11: Internal Locus of Control Item Location and Item Fit Statistics: Study 1

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.25	.04	1.32	4.4	**1.50**	6.7	.36	.52
i2I	.01	.04	.97	-.3	1.08	.9	.44	.43
i3I	-.08	.04	1.07	1.0	1.34	3.6	.40	.43
i4I	-.17	.05	.89	-1.7	.85	-1.8	.44	.39
i5I	.00	.04	1.21	2.4	**1.90**	7.4	.31	.41
i6I	.03	.04	.88	-1.1	.87	-1.4	.46	.38
i7I	-.14	.05	.91	-.8	.91	-1.0	.43	.37
i8I	.23	.04	.95	-.6	1.07	.8	.48	.44
i9I	.22	.04	1.13	1.6	**1.60**	6.0	.38	.44
i10I	-.16	.05	.97	-.3	1.03	.3	.40	.36
i11I	.16	.04	.95	-.5	1.29	3.3	.46	.44
i12I	-.08	.05	.90	-1.3	.94	-.9	.51	.46
i13I	.18	.04	1.08	.9	**1.43**	4.4	.40	.43
i14I	-.31	.06	.87	-1.9	.78	-2.6	.43	.34
i15I	-.13	.05	.99	-.1	1.08	1.0	.46	.45
Mean	.00	.04	1.01	.1	1.18	1.8		
SD	.17	.01	.13	1.6	.31	3.1		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.3.3 External Locus of Control

Item locations and fit statistics for the External locus of control scale are provided in Table 12. The item locations ranged from -.55 to .40 logits. One item demonstrated underfit using the Outfit MNSQ, but not using the Infit MNSQ.

Table 12: External Locus of Control Item Location and Item Fit Statistics: Study 1

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	-.01	.03	1.02	.3	1.01	.2	.47	.48
i2E	.06	.03	1.02	.4	1.05	.9	.47	.47
i3E	.05	.03	1.02	.3	1.09	1.3	.46	.46
i4E	.13	.03	.98	-.4	.95	-.9	.50	.48
i5E	.30	.03	.95	-.8	.89	-1.5	.47	.44
i6E	.34	.03	.83	-2.6	.79	-2.9	.49	.42
i7E	-.15	.03	.96	-.6	.95	-.9	.53	.52
i8E	-.55	.03	1.09	1.7	1.10	1.9	.53	.57
i9E	.40	.03	1.12	1.6	**1.67**	5.0	.34	.40
i10E	.30	.03	.87	-2.2	.83	-2.1	.49	.44
i11E	-.22	.03	.94	-1.1	.99	-.1	.54	.53
i12E	-.33	.03	1.23	4.2	1.22	3.9	.47	.56
i13E	.04	.03	.97	-.6	1.09	1.5	.51	.49
i14E	-.19	.03	.90	-1.9	.92	-1.5	.57	.53
i15E	-.17	.03	1.16	2.8	1.32	5.0	.42	.50
Mean	.00	.03	1.00	.1	1.06	.7		
SD	.26	.00	.11	1.8	.21	2.4		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.4 Rasch analysis gender

Rasch analysis was conducted separately for men and women[3]. The same criteria as previously discussed were used to investigate item fit.

[3] Each Rasch analysis for gender and ethnicity is not anchored and therefore not on a common metric. Direct comparison of item location values should not be conducted.

4.1.4.1 Autonomy men

Item locations and fit statistics for the Autonomy scale for men are provided in Table 13. The item locations ranged from -.38 to .48 logits. One item demonstrated underfit using the Outfit MNSQ, but not using the Infit MNSQ.

Table 13: Autonomy Item Location and Item Fit Statistics for Men: Study 1

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.48	.04	1.31	4.0	**1.64**	7.2	.45	.56
i2A	.13	.05	1.08	1.1	1.16	2.1	.50	.54
i3A	-.03	.05	1.01	.1	1.12	1.3	.46	.46
I4A	-.17	.06	1.04	.6	1.07	1.0	.48	.50
i5A	.27	.05	1.19	2.3	1.34	4.2	.47	.55
i6A	-.35	.06	.93	-.8	.92	-.9	.48	.45
i7A	-.14	.05	.95	-.5	.92	-.9	.51	.47
i8A	-.36	.06	.80	-1.7	.73	-2.6	.50	.38
i9A	.12	.05	1.07	.8	1.33	3.3	.44	.47
i10A	-.38	.06	.93	-.5	.88	-1.0	.42	.36
i11A	.09	.05	1.11	1.1	1.29	3.1	.43	.47
i12A	.16	.05	.89	-1.3	.89	-1.3	.53	.46
i13A	.11	.06	.97	-.5	.98	-.3	.54	.53
i14A	.02	.06	.86	-1.3	.89	-1.2	.55	.46
i15A	.07	.05	.88	-1.4	.90	-1.2	.56	.50
Mean	.00	.05	1.00	.1	1.07	.9		
SD	.24	.01	.13	1.5	.23	2.6		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.4.2 Autonomy women

Item locations and fit statistics for the Autonomy scale for women are provided in Table 14. The item locations ranged from -.84 to .57 logits. Two items demonstrated underfit, one on both fit measures, and the other using the Outfit MNSQ, but not using the Infit MNSQ.

Table 14: Autonomy Item Location and Item Fit Statistics for Women: Study 1

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.34	.08	1.51	3.9	**1.65**	4.8	.44	.61
i2A	.18	.10	.91	-.7	.90	-.8	.61	.57
i3A	-.01	.09	1.01	.1	1.00	.1	.50	.50
I4A	.13	.09	1.20	1.3	**1.47**	3.0	.39	.51
i5A	.57	.08	.97	-.2	1.03	.3	.57	.56
i6A	-.19	.09	.78	-1.6	.76	-1.8	.57	.50
i7A	.19	.09	1.07	.6	1.07	.6	.50	.52
i8A	-.84	.13	.85	-1.4	.78	-1.7	.50	.40
i9A	-.30	.09	1.03	.3	1.03	.3	.49	.50
i10A	-.51	.10	1.20	1.2	1.37	1.9	.32	.41
i11A	-.01	.09	.99	.0	1.15	1.1	.51	.51
i12A	-.20	.10	.75	-2.3	.73	-2.2	.60	.49
i13A	.56	.10	.83	-1.6	.81	-1.9	.65	.57
i14A	.11	.10	.81	-1.6	.79	-1.8	.59	.51
i15A	-.02	.09	1.01	.1	1.08	.6	.53	.53
Mean	.00	.09	1.00	-.1	1.04	.2		
SD	.36	.01	.19	1.5	.27	1.9		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.4.3 Internal Locus of Control men

Item locations and fit statistics for the Internal locus of control scale for men are provided in Table 15. The item locations ranged from -.23 to .22 logits. Five items demonstrated underfit using the Outfit MNSQ, but not using the Infit MNSQ.

Table 15: Internal Locus of Control Item Location and Item Fit Statistics for Men: Study 1

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.21	.04	1.29	3.4	**1.44**	5.1	.37	.51
i2I	.03	.05	.97	-.3	1.12	1.2	.44	.43
i3I	-.06	.05	1.12	1.3	**1.45**	4.1	.38	.43
i4I	-.22	.05	.84	-2.2	.78	-2.4	.48	.40
i5I	-.05	.05	1.16	1.6	**1.88**	6.2	.31	.39
i6I	.01	.05	.88	-1.0	.89	-1.0	.47	.38
i7I	-.12	.06	.93	-.5	.97	-.3	.42	.37
i8I	.22	.04	.94	-.6	1.07	.7	.48	.44
i9I	.20	.04	1.09	.9	**1.43**	4.0	.39	.44
i10I	-.15	.06	1.00	.0	1.11	1.0	.39	.36
i11I	.14	.04	.97	-.3	1.36	3.4	.45	.44
i12I	-.06	.05	.91	-.9	.93	-.8	.51	.46
i13I	.20	.04	1.12	1.1	**1.50**	4.4	.38	.43
i14I	-.23	.07	.88	-1.5	.78	-2.3	.44	.34
i15I	-.12	.05	1.00	.0	1.09	1.0	.46	.45
Mean	.00	.05	1.01	.1	1.19	1.6		
SD	.15	.01	.12	1.4	.30	2.6		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.4.4 Internal Locus of Control women

Item locations and fit statistics for the Internal locus of control scale for women are provided in Table 16. The item locations ranged from -.32 to .23 logits. Three items demonstrated underfit, one on both measures, and the other two using the Outfit MNSQ, but not using the Infit MNSQ.

Table 16: Internal Locus of Control Item Location and Item Fit Statistics for Women: Study 1

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.23	.08	**1.43**	2.9	**1.64**	4.3	.32	.52
i2I	-.07	.09	1.00	.0	.97	-.1	.42	.42
i3I	.04	.09	.93	-.4	1.02	.2	.44	.41
i4I	-.17	.11	1.06	.4	1.12	.6	.31	.35
i5I	.02	.08	1.28	1.9	**1.78**	3.4	.35	.45
i6I	-.07	.10	.92	-.3	.82	-.9	.40	.36
i7I	-.32	.13	.84	-.9	.75	-1.6	.47	.35
i8I	.05	.08	.97	-.1	1.09	.6	.44	.42
i9I	.16	.07	1.28	1.7	**2.14**	4.7	.36	.44
i10I	.04	.11	.87	-.9	.79	-1.2	.45	.35
i11I	.07	.08	.90	-.5	1.13	.8	.49	.43
i12I	.15	.09	.86	-.9	.99	.0	.50	.44
i13I	-.07	.09	.97	-.2	1.23	1.4	.44	.42
i14I	-.18	.14	.85	-1.1	.81	-.9	.41	.30
i15I	.13	.09	.97	-.1	1.05	.4	.47	.44
Mean	.00	.09	1.01	.1	1.16	.8		
SD	.14	.02	.17	1.1	.39	1.9		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.4.5 External Locus of Control men

Item locations and fit statistics for the External locus of control scale for men are provided in Table 17. The item locations ranged from -.53 to .38 logits. Two items demonstrated underfit using the Outfit MNSQ, but not using the Infit MNSQ.

Table 17: External Locus of Control Item Location and Item Fit Statistics for Men: Study 1

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	-.02	.04	1.03	.5	1.03	.5	.47	.49
i2E	.07	.04	1.04	.6	1.09	1.2	.47	.48
i3E	.08	.04	1.00	.0	1.07	.8	.47	.46
i4E	.14	.04	1.02	.3	1.00	.0	.50	.49
i5E	.31	.04	.94	-.8	.88	-1.5	.48	.44
i6E	.33	.04	.77	-3.3	.69	-3.9	.53	.43
i7E	-.18	.03	.96	-.7	.94	-.9	.54	.52
i8E	-.53	.04	1.10	1.7	1.12	1.9	.53	.57
i9E	.38	.03	1.11	1.4	**1.65**	4.6	.36	.42
i10E	.26	.03	.87	-1.9	.83	-2.0	.51	.46
i11E	-.23	.03	.93	-1.1	.99	-.1	.55	.53
i12E	-.34	.04	1.24	3.8	1.24	3.7	.46	.56
i13E	.10	.04	.90	-1.6	.88	-1.7	.55	.49
i14E	-.19	.03	.93	-1.2	.94	-.9	.57	.54
i15E	-.19	.04	1.21	3.2	**1.43**	5.8	.40	.51
Mean	.00	.04	1.00	.1	1.05	.5		
SD	.26	.00	.12	1.8	.23	2.5		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.4.6 External Locus of Control women

Item locations and fit statistics for the External locus of control scale for women are provided in Table 18. The item locations ranged from -.61 to .49 logits. Two items demonstrated underfit using the Outfit MNSQ, but not using the Infit MNSQ.

Table 18: External Locus of Control Item Location and Item Fit Statistics for Women: Study 1

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	-.13	.07	.96	-.4	.93	-.6	.46	.46
i2E	.01	.07	.95	-.4	.96	-.3	.47	.44
i3E	-.06	.07	1.01	.1	1.10	.7	.42	.43
i4E	.09	.07	.85	-1.2	.79	-1.6	.49	.42
i5E	.20	.06	.95	-.4	.88	-.7	.44	.41
i6E	.36	.08	1.10	.7	1.19	1.2	.31	.35
i7E	.09	.06	1.01	.1	.98	-.2	.49	.48
i8E	-.61	.06	1.05	.5	1.05	.6	.53	.55
i9E	.49	.07	1.19	1.1	**1.80**	2.3	.23	.31
i10E	.42	.07	.91	-.5	.89	-.5	.39	.33
i11E	-.24	.06	.98	-.1	1.01	.1	.49	.49
i12E	-.34	.06	1.17	1.6	1.16	1.4	.48	.54
i13E	-.16	.06	1.13	1.1	**1.69**	4.4	.40	.46
i14E	-.11	.06	.84	-1.6	.85	-1.4	.57	.49
i15E	-.03	.07	1.01	.1	1.01	.1	.46	.47
Mean	.00	.07	1.01	.0	1.09	.4		
SD	.28	.01	.10	.8	.28	1.5		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.5 Rasch analysis ethnicity

Rasch analysis was conducted separately for Black and White respondents. The same criteria as previously discussed were used to investigate item fit.

4.1.5.1 Autonomy Black

Item locations and fit statistics for the Autonomy scale for Black respondents are provided in Table 19. The item locations ranged from -.38 to .46 logits. Two items demonstrated underfit, one item on both fit measures, and the other using the Outfit MNSQ, but not using the Infit MNSQ.

Table 19: Autonomy Item Location and Item Fit Statistics for Black Respondents: Study 1

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.46	.04	1.34	4.0	**1.64**	.45	.45	.57
i2A	.08	.06	1.08	.9	1.16	.49	.49	.53
i3A	-.02	.05	.99	-.1	1.07	.48	.48	.47
I4A	.03	.06	1.12	1.4	1.25	.40	.40	.48
i5A	.21	.05	1.09	1.0	1.27	.49	.49	.53
i6A	-.30	.06	.90	-1.2	.86	.50	.50	.45
i7A	.01	.06	1.02	.2	.96	.47	.47	.46
i8A	-.34	.07	.80	-1.5	.75	.50	.50	.37
i9A	.08	.05	1.09	.8	**1.45**	.41	.41	.46
i10A	-.38	.07	.96	-.2	.92	.38	.38	.35
i11A	.08	.05	1.10	.9	1.36	.43	.43	.45
i12A	.06	.06	.89	-1.1	.90	.52	.52	.45
i13A	.17	.06	.91	-1.1	.89	.57	.57	.52
i14A	-.16	.06	.84	-1.6	.81	.55	.55	.46
i15A	.03	.06	.92	-.8	.95	.52	.52	.48
Mean	.00	.06	1.00	.1	1.08	.8		
SD	.22	.01	.13	1.4	.25	2.4		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.5.2 Autonomy White

Item locations and fit statistics for the Autonomy scale for White respondents are provided in Table 20. The item locations ranged from -.62 to .40 logits. One item demonstrated underfit on both fit measures.

Table 20: Autonomy Item Location and Item Fit Statistics for White Respondents: Study 1

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.40	.06	**1.40**	3.9	**1.72**	6.2	.44	.58
i2A	.33	.08	.99	.0	1.01	.1	.57	.57
i3A	-.06	.08	1.04	.3	1.12	1.0	.48	.48
I4A	.10	.08	.99	-.1	1.02	.3	.53	.53
i5A	.30	.07	1.24	2.6	1.33	3.3	.48	.59
i6A	-.21	.07	.87	-1.1	.88	-1.0	.52	.48
i7A	-.09	.07	.91	-.7	.96	-.4	.56	.50
i8A	-.62	.10	.83	-1.5	.73	-2.1	.50	.39
i9A	-.13	.07	1.06	.6	1.05	.5	.51	.52
i10A	-.44	.08	1.07	.6	1.12	.9	.39	.41
i11A	-.15	.07	1.06	.7	1.16	1.5	.48	.52
i12A	.04	.07	.85	-1.4	.83	-1.6	.57	.51
i13A	.36	.08	.94	-.7	.99	-.1	.58	.56
i14A	.05	.07	.88	-.8	.99	.0	.57	.50
i15A	.13	.08	.89	-.9	.94	-.6	.59	.53
Mean	.00	.08	1.00	.1	1.06	.5		
SD	.28	.01	.15	1.4	.22	2.0		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.5.3 Internal Locus of Control Black

Item locations and fit statistics for the Internal locus of control scale for Black respondents are provided in Table 21. The item locations ranged from -.28 to .27 logits. Five items demonstrated underfit using the Outfit MNSQ, but not using the Infit MNSQ.

Table 21: Internal Locus of Control Item Location and Item Fit Statistics for Black Respondents: Study 1

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.24	.05	1.26	2.6	**1.45**	4.3	.36	.50
i2I	.12	.05	.91	-.9	1.00	.1	.48	.45
i3I	-.14	.05	1.02	.3	1.22	1.7	.40	.42
i4I	-.23	.07	.93	-.7	.89	-.9	.41	.37
i5I	-.25	.07	1.05	.3	**1.66**	3.2	.29	.31
i6I	.07	.06	.88	-.9	.85	-1.1	.45	.38
i7I	-.20	.07	.92	-.5	.88	-.8	.40	.35
i8I	.15	.05	.91	-.9	.92	-.6	.49	.44
i9I	.27	.05	1.25	2.1	**1.88**	6.2	.35	.44
i10I	-.22	.07	.97	-.1	1.12	.8	.37	.33
i11I	.24	.05	1.04	.4	**1.51**	3.9	.44	.44
i12I	.00	.06	.91	-.8	.96	-.4	.50	.46
i13I	.22	.05	1.12	1.1	**1.50**	3.8	.41	.44
i14I	-.28	.08	.88	-1.0	.76	-1.7	.39	.30
i15I	.02	.06	1.03	.3	1.13	1.2	.42	.43
Mean	.00	.06	1.01	.1	1.18	1.3		
SD	.20	.01	.12	1.1	.33	2.3		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.5.4 Internal Locus of Control White

Item locations and fit statistics for the Internal locus of control scale for White respondents are provided in Table 22. The item locations ranged from -.42 to .27 logits. Three items demonstrated underfit, two on both fit measures and one using the Outfit MNSQ, but not using the Infit MNSQ.

Table 22: Internal Locus of Control Item Location and Item Fit Statistics for White Respondents: Study 1

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.19	.06	**1.43**	4.1	**1.62**	5.7	.32	.53
i2I	-.06	.07	1.00	.0	1.08	.7	.41	.40
i3I	-.05	.06	1.16	1.3	**1.60**	4.3	.35	.44
i4I	-.15	.07	.83	-1.8	.76	-2.0	.48	.40
i5I	.23	.06	**1.43**	3.7	**2.04**	7.5	.28	.49
i6I	-.13	.08	.87	-.7	.81	-1.4	.47	.38
i7I	-.13	.08	.90	-.6	.94	-.4	.45	.38
i8I	.27	.06	1.00	.1	1.28	2.0	.45	.43
i9I	.06	.06	.95	-.4	.93	-.6	.47	.44
i10I	-.15	.08	.98	-.1	.95	-.3	.42	.38
i11I	.09	.07	.80	-1.8	.78	-2.0	.53	.43
i12I	.16	.07	.85	-1.3	.85	-1.4	.53	.45
i13I	.03	.07	.98	-.1	1.08	.6	.43	.41
i14I	-.42	.09	.87	-1.5	.82	-1.7	.47	.37
i15I	.04	.07	.96	-.3	1.04	.4	.50	.47
Mean	.00	.07	1.00	.0	1.10	.8		
SD	.18	.01	.19	1.7	.36	2.8		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.5.5 External Locus of Control Black

Item locations and fit statistics for the External locus of control scale for Black respondents are provided in Table 23. The item locations ranged from -.44 to .50 logits. No items demonstrated overfit or underfit.

Table 23: External Locus of Control Item Location and Item Fit Statistics for Black Respondents: Study 1

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	-.03	.04	1.05	.7	1.07	.9	.42	.45
i2E	.08	.04	.98	-.3	.91	-1.1	.46	.44
i3E	.07	.04	1.01	.1	1.12	1.2	.42	.42
i4E	.06	.04	.96	-.5	.93	-1.0	.49	.46
i5E	.23	.04	.91	-1.0	.88	-1.2	.44	.40
i6E	.37	.04	.81	-2.2	.74	-2.6	.46	.38
i7E	-.15	.04	.99	-.2	.97	-.3	.50	.49
i8E	-.44	.04	1.15	2.2	1.16	2.2	.48	.54
i9E	.50	.04	1.04	.4	1.31	1.9	.32	.35
i10E	.22	.04	.91	-1.1	.86	-1.3	.45	.41
i11E	-.23	.03	.96	-.5	1.03	.5	.51	.51
i12E	-.28	.04	1.14	2.0	1.12	1.7	.47	.52
i13E	-.07	.04	1.01	.2	1.19	2.3	.47	.47
i14E	-.16	.04	.95	-.8	.96	-.6	.52	.50
i15E	-.18	.04	1.16	2.1	1.32	4.0	.39	.47
Mean	.00	.04	1.00	.1	1.04	.4		
SD	.25	.00	.09	1.2	.16	1.7		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.5.6 External Locus of Control White

Item locations and fit statistics for the External locus of control scale for White respondents are provided in Table 24. The item locations ranged from -.77 to .59 logits. Two items demonstrated underfit, one using both fit measures, and the other using the Outfit MNSQ, but not using the Infit MNSQ.

Table 24: External Locus of Control Item Location and Item Fit Statistics for White Respondents: Study 1

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	.05	.05	.97	-.3	.91	-1.0	.56	.54
i2E	.05	.05	1.13	1.3	1.34	3.1	.47	.53
i3E	.03	.06	1.02	.2	1.07	.7	.52	.51
i4E	.34	.06	.98	-.2	.97	-.3	.53	.51
i5E	.11	.05	1.01	.1	.92	-.7	.52	.51
i6E	.32	.06	.86	-1.3	.86	-1.2	.54	.48
i7E	-.11	.05	.94	-.7	.91	-1.0	.59	.57
i8E	-.77	.05	.97	-.3	.99	.0	.62	.62
i9E	.34	.05	1.28	2.5	**2.30**	5.7	.39	.48
i10E	.59	.05	.79	-2.4	.78	-1.8	.57	.49
i11E	-.16	.05	.87	-1.5	.90	-1.1	.59	.56
i12E	-.42	.05	**1.41**	4.6	**1.44**	4.7	.46	.61
i13E	-.01	.06	.86	-1.7	.81	-2.1	.59	.52
i14E	-.22	.05	.83	-2.3	.85	-1.8	.65	.58
i15E	-.13	.05	1.19	2.1	1.32	3.2	.47	.56
Mean	.00	.05	1.01	.0	1.09	.4		
SD	.32	.00	.17	1.9	.38	2.4		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.1.6 Construct validity combined sample

Construct validity of the three-factor model was investigated using confirmatory factor analysis with robust maximum likelihood estimation (Satorra & Bentler, 1988). The fit statistics for the three factor model were: robust χ^2 (942) = 1756.824, p < .001, CFI = .847, TLI = .840, RMSEA = .037 (.034 - .039), SRMR = .055. However, the baseline RMSEA was < .158 and therefore the CFI

and TLI may not be informative (Kenny, 2015). All of the factor loadings were statistically significant. The R^2 values ranged from .04 to .40. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .791, Autonomy and External locus of control = -.381, and Internal locus of control and External locus of control = -.536. The average variance extracted for each factor was: Autonomy = .240, Internal locus of control = .182, and External locus of control = .272. The unstandardised and standardised factor loadings are provided in Table 25. Convergent and discriminant validity of the three scale constructs was investigated using the technique described by McDonald (1999). Convergent/discriminant validity coefficients are obtained using coefficient ω and inter-factor correlations[4]. For the combined sample group each scale score was highly correlated with its respective factor and had smaller correlations with other factors. The Autonomy and Internal locus of control scales did, however, appear to display somewhat limited discriminant validity.

Table 25: Unstandardised and Standardised Factor Loadings: Study 1

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.52	.06	9.32	< .001	.35	.13
i2A	.49	.04	12.70	< .001	.47	.22
i3A	.52	.04	12.30	< .001	.47	.22
I4A	.40	.04	10.52	< .001	.41	.17
i5A	.53	.05	10.46	< .001	.44	.19
i6A	.56	.04	13.17	< .001	.57	.33
i7A	.50	.04	13.87	< .001	.51	.26
i8A	.44	.03	15.89	< .001	.58	.33
i9A	.46	.05	10.01	< .001	.40	.16
i10A	.33	.03	11.38	< .001	.40	.16
i11A	.45	.04	10.44	< .001	.42	.17

[4] Convergent-discriminant validity matrices are not reproduced in this report.

i12A	.65	.04	18.41	< .001	.62	.39
i13A	.56	.03	16.36	< .001	.58	.33
i14A	.60	.03	18.42	< .001	.63	.40
i15A	.59	.04	15.66	< .001	.60	.36
i1I	.26	.05	5.01	< .001	.21	.05
i2I	.55	.05	12.06	< .001	.49	.24
i3I	.39	.05	8.38	< .001	.35	.12
i4I	.50	.04	13.26	< .001	.56	.31
i5I	.22	.04	4.95	< .001	.19	.04
i6I	.51	.04	14.14	< .001	.52	.27
i7I	.39	.03	12.17	< .001	.47	.22
i8I	.66	.05	14.71	< .001	.52	.27
i9I	.37	.05	7.10	< .001	.29	.09
i10I	.30	.03	1.04	< .001	.35	.12
i11I	.61	.05	12.35	< .001	.51	.26
i12I	.56	.04	13.95	< .001	.56	.32
i13I	.40	.05	8.25	< .001	.35	.12
i14I	.36	.03	12.67	< .001	.52	.27
i15I	.46	.04	13.35	< .001	.47	.22
i1E	.71	.06	11.75	< .001	.49	.24
i2E	.68	.06	11.22	< .001	.47	.22
i3E	.71	.06	11.50	< .001	.50	.25
i4E	.78	.06	12.81	< .001	.52	.27
i5E	.81	.06	13.00	< .001	.55	.30
i6E	.85	.06	14.88	< .001	.62	.39
i7E	.91	.06	15.29	< .001	.57	.32
i8E	.75	.06	12.14	< .001	.48	.23
i9E	.60	.07	8.23	< .001	.40	.16
i10E	.92	.06	15.42	< .001	.60	.36

i11E	1.03	.06	17.28	< .001	.59	.35
i12E	.61	.07	9.32	< .001	.38	.15
i13E	.83	.06	14.35	< .001	.54	.29
i14E	1.02	.06	16.77	< .001	.61	.37
i15E	.60	.07	8.99	< .001	.40	.16

4.1.7 Construct validity Men

The fit statistics for the three factor model for men were: robust χ^2 (942) = 1479.746, p < .001, CFI = .864, TLI = .857, RMSEA = .034 (.031 - .037), SRMR = .056. However, the baseline RMSEA was < .158 and therefore the CFI and TLI may not be informative (Kenny, 2015). All of the factor loadings were statistically significant. The R^2 values ranged from .04 to .46. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .826, Autonomy and External locus of control = -.439, and Internal locus of control and External locus of control = -.557. The average variance extracted for each factor was: Autonomy = .226, Internal locus of control = .180, and External locus of control = .283. The unstandardised and standardised factor loadings are provided in Table 26. Convergent/discriminant validity coefficients painted a similar picture for men as for the combined sample.

Table 26: Unstandardised and Standardised Factor Loadings for Men: Study 1

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.54	.07	8.17	< .001	.36	.13
i2A	.46	.04	1.38	< .001	.43	.19
i3A	.49	.05	9.71	< .001	.45	.20
I4A	.41	.04	1.35	< .001	.43	.19
i5A	.47	.06	7.79	< .001	.39	.15
i6A	.49	.04	11.33	< .001	.53	.28

i7A	.50	.04	11.97	< .001	.51	.26
i8A	.46	.03	14.08	< .001	.58	.34
i9A	.45	.06	8.01	< .001	.39	.15
i10A	.36	.03	11.36	< .001	.45	.20
i11A	.39	.05	7.99	< .001	.37	.14
i12A	.65	.04	15.31	< .001	.60	.36
i13A	.51	.04	13.02	< .001	.54	.29
i14A	.58	.04	15.87	< .001	.60	.37
i15A	.61	.04	15.41	< .001	.62	.39
i1I	.28	.06	4.72	< .001	.23	.05
i2I	.53	.05	1.34	< .001	.47	.22
i3I	.36	.06	6.49	< .001	.32	.10
i4I	.57	.04	13.32	< .001	.61	.38
i5I	.21	.05	4.13	< .001	.19	.04
i6I	.51	.04	11.90	< .001	.50	.25
i7I	.38	.04	9.91	< .001	.44	.19
i8I	.65	.05	12.38	< .001	.49	.24
i9I	.42	.06	7.45	< .001	.34	.11
i10I	.29	.04	8.36	< .001	.34	.11
i11I	.60	.06	1.82	< .001	.49	.24
i12I	.56	.05	12.47	< .001	.56	.32
i13I	.39	.06	6.71	< .001	.32	.10
i14I	.39	.03	11.26	< .001	.53	.28
i15I	.47	.04	11.50	< .001	.48	.23
i1E	.73	.07	1.06	< .001	.49	.24
i2E	.70	.07	9.76	< .001	.47	.22
i3E	.75	.07	1.54	< .001	.52	.27
i4E	.77	.07	1.63	< .001	.50	.25
i5E	.82	.07	11.45	< .001	.56	.31

i6E	.98	.06	15.64	< .001	.68	.46
i7E	.95	.07	13.89	< .001	.58	.34
i8E	.75	.07	1.36	< .001	.47	.22
i9E	.65	.09	7.58	< .001	.41	.17
i10E	.98	.07	14.24	< .001	.61	.38
i11E	1.07	.07	15.78	< .001	.61	.37
i12E	.61	.08	8.05	< .001	.38	.15
i13E	.91	.06	14.94	< .001	.60	.36
i14E	1.03	.07	14.55	< .001	.60	.36
i15E	.58	.08	7.19	< .001	.38	.14

4.1.8 Construct validity Women

The fit statistics for the three factor model for women were: robust χ^2 (942) = 1368.543, $p < .001$, CFI = .738, TLI = .725, RMSEA = .053 (.047 - .059), SRMR = .089. However, the baseline RMSEA was < .158 and therefore the CFI and TLI may not be informative (Kenny, 2015). Two of the factor loadings were not statistically significant. The R^2 values ranged from .02 to .52. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .793, Autonomy and External locus of control = -.277, and Internal locus of control and External locus of control = -.360. The average variance extracted for each factor was: Autonomy = .291, Internal locus of control = .184, and External locus of control = .223. The unstandardised and standardised factor loadings are provided in Table 27. Convergent/discriminant validity coefficients painted a similar picture for women as for the combined sample.

Table 27: Unstandardised and Standardised Factor Loadings for Women: Study 1

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.44	.10	4.28	< .001	.32	.10
i2A	.56	.08	7.43	< .001	.58	.34
i3A	.62	.08	8.17	< .001	.55	.30
I4A	.36	.10	3.79	< .001	.34	.11
i5A	.68	.08	8.13	< .001	.57	.33
i6A	.78	.10	8.09	< .001	.69	.48
i7A	.52	.07	7.16	< .001	.52	.27
i8A	.39	.05	7.33	< .001	.58	.33
i9A	.45	.07	6.18	< .001	.44	.19
i10A	.21	.06	3.39	.001	.25	.06
i11A	.60	.08	7.21	< .001	.53	.29
i12A	.68	.07	1.45	< .001	.72	.52
i13A	.70	.07	1.41	< .001	.69	.47
i14A	.64	.07	9.79	< .001	.70	.49
i15A	.52	.09	5.70	< .001	.51	.26
i1I	.17	.09	1.82	.069	.15	.02
i2I	.54	.10	5.61	< .001	.54	.29
i3I	.43	.08	5.77	< .001	.42	.18
i4I	.29	.07	3.98	< .001	.37	.14
i5I	.27	.09	2.93	.003	.21	.05
i6I	.49	.08	6.42	< .001	.55	.30
i7I	.39	.05	7.40	< .001	.58	.34
i8I	.66	.09	7.42	< .001	.58	.34
i9I	.22	.12	1.89	.058	.16	.03
i10I	.29	.05	5.82	< .001	.38	.14

i11I	.62	.11	5.88	< .001	.55	.30
i12I	.56	.09	6.39	< .001	.56	.32
i13I	.44	.09	5.12	< .001	.44	.19
i14I	.28	.05	6.24	< .001	.46	.22
i15I	.45	.07	6.67	< .001	.46	.21
i1E	.63	.09	7.12	< .001	.50	.25
i2E	.65	.12	5.63	< .001	.50	.25
i3E	.58	.11	5.08	< .001	.44	.19
i4E	.76	.10	7.85	< .001	.58	.33
i5E	.72	.12	6.00	< .001	.51	.26
i6E	.32	.10	3.29	.001	.30	.09
i7E	.70	.11	6.63	< .001	.47	.23
i8E	.75	.12	6.12	< .001	.49	.24
i9E	.25	.09	2.83	.005	.21	.04
i10E	.56	.10	5.48	< .001	.46	.22
i11E	.87	.12	7.14	< .001	.51	.26
i12E	.60	.13	4.49	< .001	.38	.15
i13E	.61	.14	4.26	< .001	.39	.15
i14E	.93	.13	7.39	< .001	.62	.38
i15E	.63	.10	6.69	< .001	.48	.23

4.1.9 Construct validity Black

The fit statistics for the three factor model for Black respondents were: robust χ^2 (942) = 1327.817, $p < .001$, CFI = .861 TLI = .854, RMSEA = .033 (.029 - .059), SRMR = .037. However, the baseline RMSEA was < .158 and therefore the CFI and TLI may not be informative (Kenny, 2015). All of the factor loadings were statistically significant. The R^2 values ranged from .05 to .42. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .842, Autonomy and External locus of control = -.394, and Internal locus of control and External locus

of control = -.516. The average variance extracted for each factor was: Autonomy = .232, Internal locus of control = .183, and External locus of control = .246. The unstandardised and standardised factor loadings are provided in Table 28. Convergent/discriminant validity coefficients painted a similar picture for Black respondents as for the combined sample.

Table 28: Unstandardised and Standardised Factor Loadings for Black Respondents: Study 1

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.60	.08	7.93	< .001	.38	.15
i2A	.48	.05	9.20	< .001	.44	.19
i3A	.60	.06	9.60	< .001	.50	.25
I4A	.37	.05	6.80	< .001	.37	.14
i5A	.57	.07	7.99	< .001	.45	.20
i6A	.54	.05	1.15	< .001	.56	.32
i7A	.49	.05	9.67	< .001	.49	.24
i8A	.49	.04	13.58	< .001	.59	.35
i9A	.48	.07	6.86	< .001	.39	.15
i10A	.34	.04	8.24	< .001	.41	.17
i11A	.43	.06	7.30	< .001	.38	.14
i12A	.63	.05	12.66	< .001	.59	.34
i13A	.58	.05	12.64	< .001	.59	.34
i14A	.60	.05	13.01	< .001	.65	.42
i15A	.60	.06	1.82	< .001	.57	.33
i1I	.33	.07	4.85	< .001	.28	.08
i2I	.67	.07	1.06	< .001	.56	.31
i3I	.44	.06	7.23	< .001	.40	.16
i4I	.43	.05	8.67	< .001	.52	.27
i5I	.23	.05	4.70	< .001	.27	.07

i6I	.56	.06	1.08	< .001	.52	.27
i7I	.36	.04	8.24	< .001	.44	.19
i8I	.69	.06	12.18	< .001	.55	.30
i9I	.29	.08	3.81	< .001	.23	.05
i10I	.30	.04	7.09	< .001	.36	.13
i11I	.56	.07	8.07	< .001	.43	.19
i12I	.51	.06	9.12	< .001	.51	.26
i13I	.42	.08	5.62	< .001	.33	.11
i14I	.33	.04	8.09	< .001	.51	.26
i15I	.40	.05	8.48	< .001	.41	.17
i1E	.64	.08	7.91	< .001	.44	.19
i2E	.73	.08	8.85	< .001	.49	.24
i3E	.73	.09	8.37	< .001	.48	.23
i4E	.80	.08	9.51	< .001	.50	.25
i5E	.86	.09	9.78	< .001	.57	.32
i6E	.87	.08	11.30	< .001	.63	.39
i7E	.88	.09	1.21	< .001	.53	.28
i8E	.65	.09	7.55	< .001	.40	.16
i9E	.57	.09	6.09	< .001	.40	.16
i10E	.90	.09	1.34	< .001	.55	.31
i11E	1.05	.09	12.23	< .001	.55	.31
i12E	.65	.09	7.54	< .001	.40	.16
i13E	.80	.09	9.29	< .001	.49	.24
i14E	.96	.09	1.81	< .001	.55	.30
i15E	.55	.09	5.92	< .001	.37	.13

4.1.10 Construct validity White

The fit statistics for the three factor model for White respondents were: robust χ^2 (942) = 1592.288, $p < .001$, CFI = .786, TLI = .775, RMSEA = .050 (.046 - .054), SRMR = .037. However, the baseline RMSEA was < .158 and therefore the CFI and TLI may not be informative (Kenny, 2015). Two factor loadings were non-significant. The R^2 values ranged from .00 to .48. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .732, Autonomy and External locus of control = -.385, and Internal locus of control and External locus of control = -.584. The average variance extracted for each factor was: Autonomy = .257, Internal locus of control = .192, and External locus of control = .318. The unstandardised and standardised factor loadings are provided in Table 29. Convergent/discriminant validity coefficients painted a similar picture for Black respondents as for the combined sample.

Table 29: Unstandardised and Standardised Factor Loadings for White Respondents: Study 1

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.40	.08	4.83	< .001	.31	.10
i2A	.49	.06	8.75	< .001	.52	.27
i3A	.42	.05	8.64	< .001	.46	.21
I4A	.45	.05	8.70	< .001	.46	.22
i5A	.45	.07	6.61	< .001	.40	.16
i6A	.60	.07	8.62	< .001	.59	.34
i7A	.53	.05	1.25	< .001	.56	.31
i8A	.38	.04	9.07	< .001	.57	.33
i9A	.41	.05	8.37	< .001	.42	.18
i10A	.30	.04	7.57	< .001	.37	.14
i11A	.48	.06	7.93	< .001	.47	.23
i12A	.66	.05	14.40	< .001	.66	.44

i13A	.55	.05	11.01	< .001	.59	.34
i14A	.60	.04	13.60	< .001	.61	.38
i15A	.56	.05	11.99	< .001	.63	.40
i1I	.13	.08	1.67	.095	.11	.01
i2I	.40	.06	6.91	< .001	.43	.18
i3I	.28	.08	3.64	< .001	.25	.06
i4I	.58	.06	1.18	< .001	.60	.36
i5I	.09	.08	1.17	.242	.07	.00
i6I	.45	.04	1.10	< .001	.52	.27
i7I	.41	.05	8.44	< .001	.50	.25
i8I	.60	.08	8.02	< .001	.47	.22
i9I	.48	.06	7.85	< .001	.38	.15
i10I	.27	.04	6.66	< .001	.32	.10
i11I	.70	.06	1.92	< .001	.67	.45
i12I	.63	.06	1.83	< .001	.63	.40
i13I	.39	.05	7.46	< .001	.40	.16
i14I	.38	.04	9.47	< .001	.53	.28
i15I	.50	.05	1.14	< .001	.53	.28
i1E	.80	.09	8.86	< .001	.57	.32
i2E	.63	.09	6.93	< .001	.45	.20
i3E	.68	.09	7.94	< .001	.52	.27
i4E	.77	.09	8.85	< .001	.57	.33
i5E	.74	.09	8.78	< .001	.54	.29
i6E	.83	.09	9.75	< .001	.62	.38
i7E	.94	.08	12.09	< .001	.62	.38
i8E	.86	.09	1.13	< .001	.58	.34
i9E	.63	.11	5.50	< .001	.40	.16
i10E	.95	.08	11.82	< .001	.68	.46
i11E	1.00	.08	12.56	< .001	.67	.45

i12E	.57	.10	5.56	< .001	.36	.13
i13E	.87	.07	13.19	< .001	.65	.42
i14E	1.08	.08	13.78	< .001	.70	.48
i15E	.66	.09	7.18	< .001	.45	.20

4.1.11 Measurement invariance

A nested model approach was used to investigate measurement invariance by creating increasingly constrained models (Vandenberg & Lance, 2000). Four models were stipulated: (M1) configural invariance (the same factor structure across both groups), (M2) metric/weak invariance (equality of factor loadings), (M3) scalar/strong invariance (equality of factor loadings and indicator intercepts), and (M4) strict invariance (equality of factor loadings, indicator intercepts, indicator residuals) (Brown, 2015). Comparison of the different levels of invariance was investigated by inspecting scale-corrected χ^2 differences and Δ CFI values (Satorra & Bentler, 2001). A Δ CFI value > .010 (Cheung & Rensvold, 2002) was used to indicate substantial difference in model fit (Hirschfeld & Brachel, 2014). Because the null model RMSEA < .158 the Δ CFI values must be interpreted with caution. The results indicated that scalar equivalence was tenable for Gender and that metric equivalence was tenable for ethnicity.

Table 30: Measurement Invariance for Gender: Study 1

Model	χ^2	*df*	*p*	CFI	RMSEA
Model 1: Configural	2858.229	1884	< .001	.829	.040
Model 2: Metric	2932.581	1926	< .001	.823	.040
Model 3: Scalar	3015.065	1968	< .001	.816	.041
Model 4: Strict	3220.630	2013	< .001	.788	.043
	Δ χ^2	Δ *df*	*P*	Δ CFI	
Model 1 vs. Model 2	74.69	42	.001	**.006**	
Model 2 vs. Model 3	99.34	42	< .001	**.007**	
Model 3 vs. Model 4	702.51	45	< .001	.028	

Note. Δ CFI < .01 in bold.

Because the full three factor model had a baseline RMSEA < .158 measurement invariance was further investigated on each factor individually. The results for gender indicated that metric equivalence was viable for the Autonomy factor and that scalar equivalence was viable for the Internal locus of control factor. Metric equivalence was not established for the External locus of control factor. For ethnicity Autonomy and External locus of control demonstrated metric invariance. Metric invariance was not established for the Internal locus of control factor. Partial-measurement invariance was not investigated[5]. Rather, item response theory was used to investigate differential item functioning at the item level and differential test functioning was used to investigate overall differential item functioning across each scale.

[5] Full measurement invariance may not be met because of some ideas displaying non-invariance.

Table 31: Measurement Invariance for Ethnicity: Study 1

Model	χ^2	*df*	*p*	CFI	RMSEA
Model 1: Configural	2914.467	1884	< .001	.822	.041
Model 2: Metric	2980.101	1926	< .001	.818	.041
Model 3: Scalar	3222.197	1968	< .001	.784	.044
Model 4: Strict	3533.573	2013	< .001	.738	.048
	Δ χ^2	Δ *df*	*P*	Δ CFI	
Model 1 vs. Model 2	65.78	42	.011	**.004**	
Model 2 vs. Model 3	1630.53	42	< .001	.034	
Model 3 vs. Model 4	217.97	45	< .001	.046	

Note. Δ CFI < .01 in bold.

4.1.12 Differential item functioning

Uniform and non-uniform DIF was investigated by subjecting for each scale the standardised residuals of the Rasch analysis to a two-way ANOVA with gender/ethnicity and trait level as independent variables and expected item score as dependent variable (Andrich & Hagquist, 2014). From a DIF perspective an interaction of trait and group membership indicates non-uniform DIF, whereas a main effect for group membership indicates uniform DIF. Following the guidelines of Andrich and Hagquist (2014), a Bonferroni[6] correction was applied to the *p* values for each ANOVA analysis. A DIF contrast ≥ .50 logits was used to indicate practical significance of uniform DIF (Linacre, 2014; Tennant & Pallant, 2007). The results for Gender indicate that no items displayed statistically significant uniform DIF. One item displayed statistically significant non-uniform DIF. For Ethnicity four items demonstrated statistically significant uniform DIF. However, only one item had practically significant DIF. One item for ethnicity displayed statistically significant non-uniform DIF.

[6] The Bonferroni correction was applied to the numbers of items only (i.e., .05 divided by 15), not to the number of hypotheses (i.e., .05 divided by 45). This was done to conserve power.

Table 32: Uniform and Non-Uniform DIF by Gender: Study 1

Item	Uniform			Non-Uniform DIF	
	F	*p*	Contrast	*F*	*p*
i1A	2.888	.090	.09	1.592	.175
i2A	.001	.975	.00	.468	.760
i3A	4.493	.034	-.15	.565	.688
I4A	.151	.698	.00	3.681	.006
i5A	4.160	.042	-.17	1.002	.406
i6A	4.413	.036	.27	.764	.549
i7A	.775	.379	.04	.130	.971
i8A	.321	.571	-.11	1.441	.219
i9A	4.430	.036	-.22	1.364	.245
i10A	1.797	.181	.00	2.564	.037
i11A	1.655	.199	-.05	1.321	.261
i12A	2.207	.138	-.15	1.114	.349
i13A	3.639	.057	.27	1.584	.177
i14A	1.131	.288	.12	1.460	.213
i15A	1.280	.258	.10	.348	.845
i1I	.202	.653	.10	2.208	.067
i2I	.089	.765	-.04	1.831	.121
i3I	1.384	.240	-.05	.902	.462
i4I	.494	.482	-.18	2.302	.057
i5I	3.507	.062	.28	.598	.664
i6I	.014	.906	-.09	.712	.584
i7I	1.373	.242	-.17	1.775	.132
i8I	.123	.726	.00	1.628	.165
i9I	.082	.775	.06	1.655	.159

i10I	.013	.908	.00	2.195	.068
i11I	.508	.476	.06	1.277	.278
i12I	.435	.510	-.09	.486	.746
i13I	.750	.387	-.05	.929	.447
i14I	1.207	.272	-.25	1.105	.353
i15I	.123	.726	.04	.292	.883
i1E	.206	.650	-.04	.319	.866
i2E	1.249	.264	-.06	.592	.669
i3E	5.689	.017	-.17	1.401	.232
i4E	.107	.743	.04	1.380	.239
i5E	1.972	.161	-.06	1.022	.395
i6E	.682	.409	.10	**4.977**	**.001**
i7E	1.034	.310	.05	.850	.494
i8E	.503	.478	-.03	.523	.719
i9E	3.291	.070	.12	1.715	.145
i10E	8.398	.004	.24	2.350	.053
i11E	.113	.737	.03	.736	.568
i12E	.036	.849	-.03	.505	.732
i13E	3.577	.059	-.12	1.790	.129
i14E	.046	.830	.00	.808	.520
i15E	.096	.757	.00	2.664	.032

Note. Bonferroni *p* value = .003.

Table 33: Uniform and Non-Uniform DIF by Ethnicity: Study 1

Item	Uniform			Non-Uniform DIF	
	F	*p*	Contrast	*F*	*p*
i1A	.013	.910	.05	.727	.574
i2A	1.593	.207	-.12	.503	.733
i3A	5.034	.025	.25	1.002	.406
I4A	.037	.848	-.09	2.654	.032
i5A	2.749	.098	-.08	2.927	.020
i6A	.858	.355	.02	1.147	.333
i7A	.443	.506	.00	1.801	.127
i8A	4.834	.028	.24	.595	.666
i9A	.085	.771	.00	1.023	.394
i10A	.756	.385	-.09	1.410	.229
i11A	.013	.908	.00	.343	.849
i12A	.335	.563	-.07	.561	.691
i13A	6.879	.009	.23	.473	.756
i14A	.640	.424	-.13	.515	.725
i15A	4.793	.029	-.19	.123	.974
i1I	4.979	.026	-.08	2.238	.064
i2I	**15.273**	.000	.36	.825	.509
i3I	1.640	.201	-.04	1.119	.347
i4I	.160	.689	-.06	1.821	.123
i5I	**85.133**	.000	-.72	3.522	.007
i6I	2.861	.091	.12	2.396	.049
i7I	.368	.545	-.11	.328	.859
i8I	.196	.658	.05	.767	.547
i9I	7.331	.007	.15	**6.146**	.000
i10I	.482	.488	-.15	1.330	.257

i11I	8.390	.004	.21	.598	.664
i12I	7.339	.007	.14	1.455	.214
i13I	8.561	.004	.30	1.349	.250
i14I	4.103	.043	-.33	.665	.617
i15I	2.029	.155	-.18	1.455	.214
i1E	.098	.755	.00	2.617	.034
i2E	.548	.460	.00	1.505	.199
i3E	4.055	.044	.13	1.159	.328
i4E	**11.295**	.001	-.23	.440	.780
i5E	4.387	.037	.11	1.578	.179
i6E	6.301	.012	.13	.711	.584
i7E	.741	.390	-.03	.341	.851
i8E	5.661	.018	.14	3.065	.016
i9E	3.724	.054	.15	.116	.977
i10E	.413	.521	-.02	.232	.920
i11E	4.441	.035	-.13	2.401	.049
i12E	.642	.423	.06	1.723	.143
i13E	**14.356**	.000	-.23	2.032	.088
i14E	1.087	.298	.03	.322	.863
i15E	1.419	.234	-.07	.848	.495

Note. Bonferroni *p* value = .003.

4.1.13 Differential test functioning

The combined effect of DIF across each scale was investigated using the differential test functioning procedures described by Penfield and Algina (2006). Their approach is an unsigned variance-based technique and is appropriate for dichotomous and polytomous items (Penfield, 2007; Penfield & Algina, 2006). It is based on the Liu and Agresti (1996) cumulative common odds ratio (for polytomous items). The variance of the generalised DIF effect is given as an unweighted

and weighted value denoted by v^2. Weighted v^2 was used as an indicator of differential test functioning in this analysis. Suggested differential test functioning interpretation criteria for v^2 is small = < .07, medium = .07 to .14, and large > .14 (Penfield & Algina, 2006). The DIFAS (Penfield, 2005) software was used to calculate v^2. The results are presented in Table 34. The results indicate minimal differential test functioning across the three scales for gender. For ethnicity, the Autonomy scale demonstrated minimal evidence of differential test functioning. The External scale demonstrated small to medium differential test functioning, while the Internal locus of control scale demonstrated large differential test functioning.

Table 34: Differential Test Functioning: Study 1

Scale	Gender v^2	Ethnicity v^2
Autonomy	.021	.029
Internal locus of control	.014	.196
External locus of control	.024	.074

4.1.14 Correlation coefficients

Pearson correlation coefficients and Spearman-rho rank order correlation coefficients for the LCI 5th edition scales are reported in Table 35. Inspection of the non-parametric Loess regression lines (Cleveland, 1979) indicated that for the most part the relationships between the variables were linear. Inspection of multivariate normality using Mardia's coefficient (Mardia, 1970) and contour plots found that bivariate normality was not met across the three scales. The correlation coefficients had medium to large effect sizes (Cohen, 1988).

Table 35: Pearson and Spearman-Rho Rank Order Correlations: Study 1

	Autonomy	Internal LOC	External LOC
Autonomy	.	.62***	-.34***
Internal LOC	.62***	.	-.38***
External LOC	-.32***	-.38***	.

Note. Pearson correlations below the diagonal, Spearman rho rank-order correlations above the diagonal. *** = $p < .001$.

4.1.15 Mean score differences for gender

Differences in group centroids for gender were investigated using Hotelling's T^2 test. The results indicate that there was a statistically significant difference in the group centroids between men and women [$T^2(3, 641) = 14.925$, $p < .001$]. Post-hoc independent samples *t* tests with a Holm-Bonferroni correction were subsequently applied. The results indicated that there were small, but statistically significant, differences in the means for men and women on the Internal [*M* men = 91.77, SD = 7.68, *M* women = 93.66, SD = 7.11, $t(643) = 2.753$, $p = .012_{adj}$, $d = .26$] and External [*M* men = 43.65, SD = 13.31, *M* women = 39.14, SD = 10.68, $t(643) = -3.895$, $p_{adj} < .001$, $d = .37$] locus of control scales. There was not a statistically significant difference in the means for men and women on the Autonomy scale [*M* men = 88.86, SD = 8.19, *M* women = 87.38, SD = 8.90, $t(643) = -1.942$, $p_{adj} = .053$, $d = .17$].

4.1.16 Mean score differences for Ethnicity

Differences in group centroids for Ethnicity were investigated using Hotelling's T^2 test (caution must be used in interpretation of the results because scalar invariance was not established). The results indicate that there was a statistically significant difference in the group centroids between the Black and White respondents [$T^2(3, 641) = 8.467$, $p < .001$]. Post-hoc independent samples *t* tests with a Holm-Bonferroni correction were subsequently applied. The results indicated that there were small, but statistically significant differences, in the means for Black and White

respondents on the Internal scale [*M* Black = 93.36, SD = 7.53, *M* White = 90.72, SD = 7.40, *t*(643) = 4.441, p_{adj} < .001, *d* = .35]. There were no statistically significant differences in the means for the Black and White respondents on the Autonomy [*M* Black = 89.01, SD = 8.63, *M* White = 87.78, SD = 8.01, *t*(643) = 1.854, p_{adj} = .128, *d* = .15] and External locus of control [*M* Black = 42.67, SD = 12.84, *M* White = 42.43, SD = 12.88, *t*(643) = .348, p_{adj} = .728, *d* = .02] scales.

4.1.17 Summary

Based on the results of Study 1, the LCI appears to have acceptable reliability across gender and ethnic groups. The three-factor structure is supported by the factor analysis, and the factors appear to be mostly unidimensional. Only one or two items demonstrated underfit using the Infit MNSQ measure in the comparison groups, but there was no evidence of misfit for the overall sample using the Infit MNSQ. Analysis of DIF indicated one case of non-uniform DIF across gender and ethnicity, and one item demonstrating practically significant DIF across ethnic groups. This does not necessarily indicate problems with these items because the DIF analyses are based on the sample rather than the population. Thus, further studies are required to investigate the psychometric properties of these items (i.e., cross-validations are required before definitive conclusions can be made). Further studies should also investigate differential test functioning. The mean differences across groups were generally small but do imply that caution must be used when comparing scores across groups.

4.2 Study 2

4.2.1 Descriptive Statistics

Descriptive statistics for the three scales are presented in Table 36. Histograms and bean plots for the scale scores are provided in Figure 4 to Figure 6. As with Study 1, the Autonomy and

Internal locus of control scales were negatively skewed and the External locus of control scale positively skewed.

Table 36: Descriptive Statistics for the Scale Scores: Study 2

Scale	Mean	SD	Median	Skewness	Kurtosis	SE
Autonomy	87.06	8.92	88.00	-0.28	-0.24	0.43
Internal	91.00	7.82	91.00	-0.33	-0.26	0.65
External	44.16	13.47	42.00	0.61	0.41	0.65

Note. SD = standard deviation, SE = Standard error.

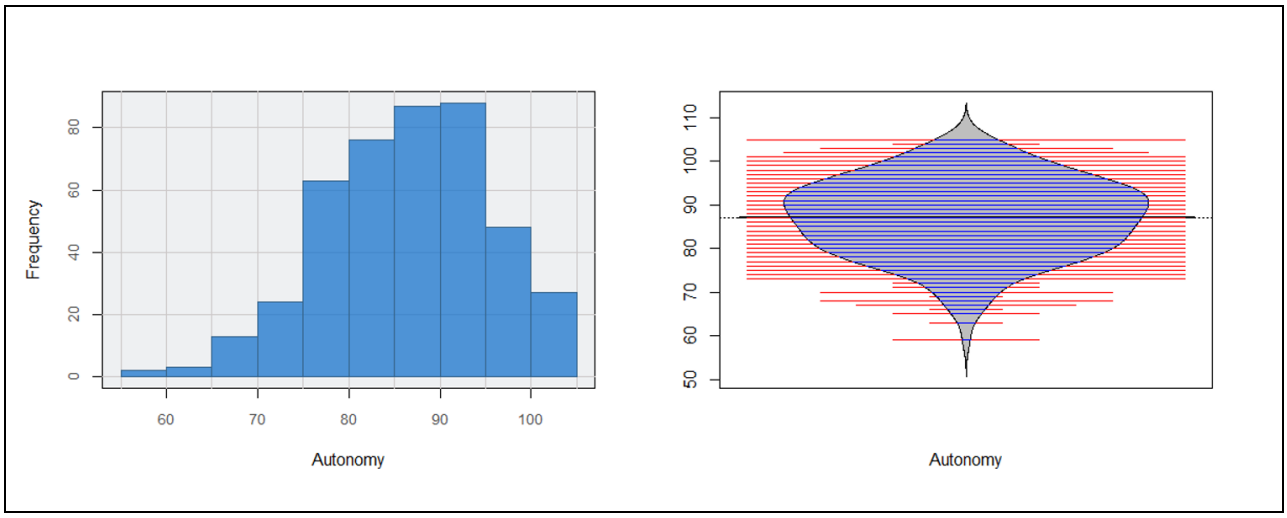


Figure 4: Histogram and beanplot for the Autonomy scale.

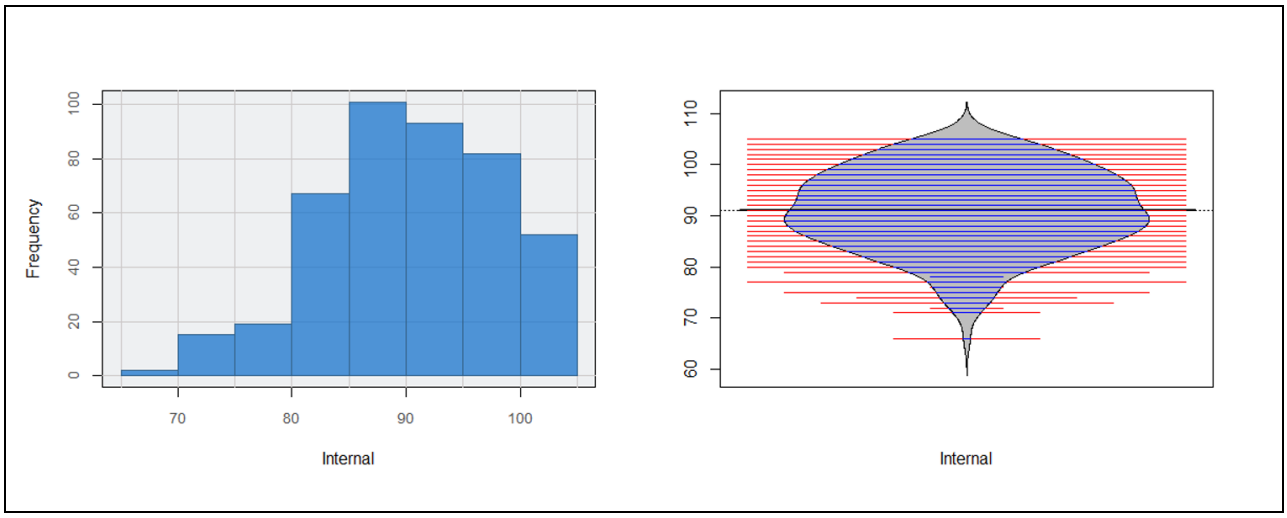


Figure 5: Histogram and beanplot for the Internal locus of control scale.

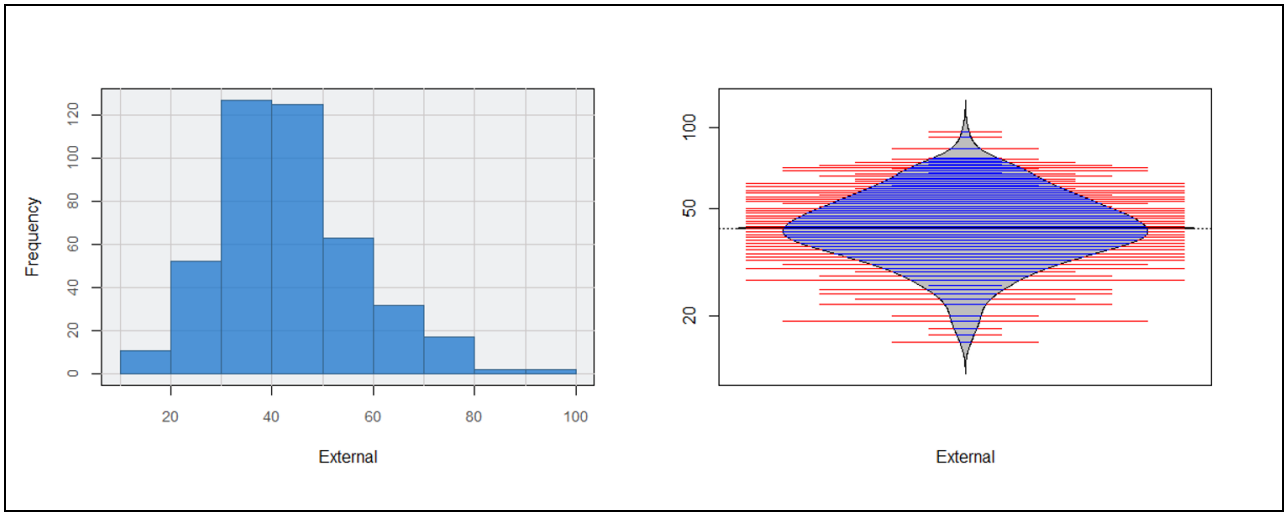


Figure 6: Histogram and beanplot for the External locus of control scale.

4.2.2 Reliability

Reliability coefficients for the scale items of the LCI 5th edition are presented in Table 37. Cronbach alpha coefficients (Cronbach, 1951), Guttman's Lambda 2 (Guttman, 1945), and McDonald's Omega total (McDonald, 1999; Revelle & Zinbarg, 2009) were used as measures of

reliability. Item and Person separation reliability estimates from the Rasch analysis are also presented. As a whole the reliability coefficients were all acceptable.

Table 37: Reliability Coefficients for the Scale Items: Study 2

Scale	α	λ_2	ω	IR	PR
Autonomy	.83 (.80 - .86)	.83	.84	.95	.79
Internal	.78 (.74 - .82)	.78	.80	.89	.73
External	.86 (.83 - .89)	.86	.86	.98	.83

Note. 95% confidence intervals for α in parentheses. IR = Item separation reliability, PR = Person separation reliability.

Reliability coefficients for gender and ethnicity are provided in Tables 38 to 41. As for Study 1, comparison of Cronbach alpha coefficients across gender and ethnicity were conducted. The results indicated that there was no statistically significant difference in the alpha coefficients for men and women on the Autonomy (p = .71) and Internal locus of control (p = 1.00) scales. There was a statistically significant difference on the External locus of control (p = .03) scale.

Table 38: Reliability Coefficients for the Scale Items for Men: Study 2

Scale	α	O α	λ_2	ω	IR	PR
Autonomy	.82 (.78 - .86)	.90	.84	.84	.92	.78
Internal	.78 (.73 - .82)	.89	.78	.79	.81	.73
External	.87 (.84 - .90)	.89	.87	.87	.97	.83

Note. 95% confidence intervals for α in parentheses.

Table 39: Reliability Coefficients for the Scale Items for Women: Study 2

Scale	α	O α	λ_2	ω	IR	PR
Autonomy	.83 (.77 - .88)	.87	.83	.85	.91	.78
Internal	.78 (.72 - .85)	.89	.79	.82	.84	.73
External	.82 (.77 - .88)	.84	.83	.83	.96	.83

Note. 95% confidence intervals for α in parentheses.

For ethnicity there was a statistically significant difference in the alpha coefficients for the Autonomy (p = .01) and Internal locus of control (p = .01) scales. There was no difference in the alpha coefficients for the External locus of control scale (p = .26). However, because the reliability coefficients were high for all comparison groups, these differences are not seen to have a great impact on the overall interpretation of results on the scales across groups.

Table 40: Reliability Coefficients for the Scale Items for Black Respondents: Study 2

Scale	α	O α	λ_2	ω	IR	PR
Autonomy	.77 (.71 - .84)	.88	.78	.80	.82	.73
Internal	.70 (.61 - .78)	.89	.71	.72	.78	.67
External	.84 (.79 - .89)	.86	.85	.84	.95	.79

Note. 95% confidence intervals for α in parentheses.

Table 41: Reliability Coefficients for the Scale Items for White Respondents: Study 2

Scale	α	O α	λ_2	ω	IR	PR
Autonomy	.86 (.81 - .91)	.89	.87	.87	.86	.83
Internal	.81 (.75 - .88)	.90	.82	.84	.80	.76
External	.87 (.83 - .92)	.90	.88	.88	.95	.84

Note. 95% confidence intervals for α in parentheses.

4.2.3 Item Descriptive Statistics

The average inter-item correlation coefficients and item-total correlation coefficients for the LCI 5th edition scale items are presented in Tables 42 to 44. The average inter-item correlation coefficients and item-total correlation coefficients were positive across all the scales.

Table 42: Item Level Descriptive Statistics for the Autonomy Scale: Study 2

Item	Mean	SD	Average R	R Cor	R Drop
i1A	5.1	1.56	.27	.36	.33
i2A	5.5	1.06	.26	.53	.49
i3A	5.9	1.17	.27	.43	.39
I4A	5.9	1.05	.27	.38	.34
i5A	5.3	1.34	.27	.43	.40
i6A	5.9	1.12	.26	.57	.51
i7A	5.9	.99	.25	.60	.55
i8A	6.3	.78	.26	.54	.49
i9A	5.9	1.08	.27	.43	.38
i10A	6.4	.89	.27	.42	.38
i11A	5.9	1.09	.26	.51	.46
i12A	6.0	1.03	.25	.63	.58
i13A	5.6	1.05	.25	.62	.55
i14A	5.9	.93	.25	.67	.59
i15A	5.6	1.03	.26	.57	.52

Note. Average R = average inter-item correlation, R Cor = item whole correlation corrected for item overlap and scale reliability, R Drop = item whole correlation against the scale without the item.

Table 43: Item Level Descriptive Statistics for the Internal Locus of Control Scale: Study 2

Item	Mean	SD	Average R	R Cor	R Drop
i1I	5.6	1.24	.22	.23	.20
i2I	6.1	.98	.20	.51	.43
i3I	6.0	1.24	.20	.42	.36
i4I	6.3	.89	.20	.44	.39
i5I	6.0	1.14	.21	.29	.24
i6I	6.2	.95	.19	.59	.50
i7I	6.3	.91	.20	.57	.49
i8I	6.0	1.20	.20	.50	.43
i9I	5.9	1.19	.21	.40	.35
i10I	6.4	.92	.20	.46	.41
i11I	5.9	1.24	.21	.38	.33
i12I	5.9	.97	.19	.58	.51
i13I	6.0	1.15	.21	.35	.30
i14I	6.5	.70	.19	.61	.54
i15I	5.9	.99	.20	.48	.42

Note. Average R = average inter-item correlation, R Cor = item whole correlation corrected for item overlap and scale reliability, R Drop = item whole correlation against the scale without the item.

Table 44: Item Level Descriptive Statistics for the External Locus of Control Scale: Study 2

Item	Mean	SD	Average R	R Cor	R Drop
i1E	2.8	1.4	.29	.51	.47
i2E	2.8	1.5	.29	.49	.45
i3E	2.8	1.5	.29	.54	.49
i4E	2.5	1.5	.28	.57	.52
i5E	2.6	1.6	.28	.59	.55

i6E	2.3	1.5	.28	.60	.55
i7E	3.3	1.6	.28	.61	.57
i8E	4.2	1.5	.29	.51	.47
i9E	2.0	1.4	.30	.39	.36
i10E	2.5	1.6	.29	.54	.50
i11E	3.4	1.8	.29	.55	.50
i12E	3.8	1.6	.29	.50	.47
i13E	2.7	1.5	.28	.60	.55
i14E	3.3	1.7	.28	.66	.61
i15E	3.2	1.5	.30	.38	.34

Note. Average R = average inter-item correlation, R Cor = item whole correlation corrected for item overlap and scale reliability, R Drop = item whole correlation against the scale without the item.

4.2.4 Rasch analysis

A Rasch (1960) partial-credit model (Wright & Masters, 1982) analysis was conducted on each scale of the LCI 5th edition. The same criteria as previously discussed were used to investigate item fit.

4.2.4.1 Autonomy

Item locations and fit statistics for the Autonomy scale are provided in Table 45. The item locations ranged from -.48 to .53 logits. One item demonstrated underfit on both the Infit and Outfit MNSQ, while three items demonstrated underfit only on the Outfit MNSQ.

Table 45: Autonomy Item Location and Item Fit Statistics: Study 2

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.53	.04	**1.48**	6.0	**1.82**	8.9	.44	.58
i2A	.15	.05	.97	-.4	1.05	.7	.54	.54
i3A	-.02	.05	1.11	1.2	**1.41**	4.2	.46	.49
I4A	.00	.05	1.12	1.3	**1.43**	4.5	.43	.49
i5A	.37	.05	1.21	2.6	**1.48**	5.6	.49	.56
i6A	.00	.05	.93	-.8	1.07	.9	.52	.49
i7A	-.09	.06	.85	-1.7	.83	-2.1	.55	.49
i8A	-.44	.07	.83	-1.7	.84	-1.8	.50	.42
i9A	-.03	.05	1.07	.8	1.26	2.7	.46	.48
i10A	-.48	.06	.99	.0	1.08	.7	.41	.40
i11A	-.04	.05	.98	-.2	1.11	1.3	.50	.50
i12A	-.18	.06	.85	-1.7	.84	-1.9	.56	.47
i13A	.17	.06	.89	-1.6	.90	-1.5	.58	.53
i14A	-.14	.06	.78	-3.1	.77	-3.3	.59	.49
i15A	.19	.06	.90	-1.1	.97	-.4	.58	.52
Mean	.00	.05	1.00	.0	1.12	1.2		
SD	.26	.01	.17	2.1	.29	3.3		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.4.2 Internal Locus of Control

Item locations and fit statistics for the Internal locus of control scale are provided in Table 46. The item locations ranged from -.32 to .28 logits. Three items demonstrated underfit but only on the Outfit MNSQ.

Table 46: Internal Locus of Control Item Location and Item Fit Statistics: Study 2

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.07	.05	1.35	4.4	**1.62**	6.9	.38	.52
i2I	-.14	.06	.94	-.6	1.13	1.4	.45	.43
i3I	.10	.05	1.04	.5	1.29	2.6	.42	.44
i4I	-.17	.06	.93	-.7	1.02	.3	.44	.41
i5I	.08	.05	1.25	3.1	**1.56**	5.3	.35	.47
i6I	-.17	.06	.86	-1.4	.86	-1.5	.49	.42
i7I	-.09	.06	.87	-1.1	.84	-1.6	.47	.40
i8I	.27	.05	.96	-.4	1.11	1.1	.48	.44
i9I	.14	.05	1.06	.7	1.24	2.5	.44	.47
i10I	-.06	.06	.94	-.4	.88	-1.1	.42	.38
i11I	.28	.05	1.12	1.2	**1.46**	4.3	.45	.47
i12I	-.05	.06	.86	-1.7	.88	-1.5	.55	.48
i13I	.18	.05	1.12	1.2	1.39	3.7	.41	.45
i14I	-.32	.07	.77	-1.9	.64	-3.5	.47	.34
i15I	-.13	.06	1.02	.3	1.18	2.3	.47	.48
Mean	.00	.05	1.01	.2	1.14	1.4		
SD	.17	.01	.15	1.7	.28	2.8		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.4.3 External Locus of Control

Item locations and fit statistics for the External locus of control scale are provided in Table 47. The item locations ranged from -.64 to .47 logits. One item demonstrated underfit on the Outfit MNSQ.

Table 47: External Locus of Control Item Location and Item Fit Statistics: Study 2

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	.11	.04	1.01	.2	1.02	.4	.53	.53
i2E	.07	.04	1.05	.8	1.06	.8	.51	.54
i3E	.10	.04	1.00	.0	1.02	.3	.55	.54
i4E	.21	.04	.96	-.6	.98	-.2	.56	.53
i5E	.21	.04	.92	-1.1	1.15	1.7	.56	.53
i6E	.28	.04	.88	-1.5	1.13	1.3	.55	.51
i7E	-.19	.04	.91	-1.5	.87	-1.9	.61	.56
i8E	-.64	.04	1.06	.9	1.09	1.3	.56	.58
i9E	.47	.04	1.20	2.0	1.28	2.2	.43	.48
i10E	.21	.04	1.03	.4	.97	-.2	.54	.53
i11E	-.30	.03	1.05	.9	1.12	1.6	.55	.58
i12E	-.41	.04	1.09	1.3	1.12	1.8	.54	.59
i13E	.18	.04	.92	-1.2	.92	-1.0	.58	.54
i14E	-.08	.04	.83	-2.9	.81	-3.0	.64	.57
i15E	-.23	.04	1.27	3.7	**1.41**	5.2	.42	.55
Mean	.00	.04	1.01	.1	1.06	.7		
SD	.29	.00	.11	1.6	.15	1.9		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.5 Rasch analysis gender

Rasch analysis[7] was conducted separately for men and women. The same criteria as previously discussed were used to investigate item fit.

[7] As with Study 1 anchoring was used. Therefore the item locations are not on the same metric.

4.2.5.1 Autonomy men

Item locations and fit statistics for the Autonomy scale for men are provided in Table 48. The item locations ranged from -.45 to .43 logits. Three items demonstrated underfit, one on both the Infit and Outfit MNSQ, and the other two only on the Outfit MNSQ.

Table 48: Autonomy Item Location and Item Fit Statistics for Men: Study 2

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.36	.05	**1.52**	4.9	**1.86**	6.9	.42	.55
i2A	.02	.07	.96	-.3	1.08	.9	.54	.54
i3A	.04	.06	1.17	1.4	**1.61**	4.5	.43	.48
I4A	-.03	.07	1.11	.9	**1.54**	4.3	.41	.48
i5A	.32	.06	1.07	.8	1.28	2.7	.53	.56
i6A	-.30	.07	.84	-1.5	.94	-.6	.53	.46
i7A	-.07	.07	.88	-.9	.88	-1.1	.51	.47
i8A	-.38	.08	.81	-1.5	.85	-1.3	.48	.42
i9A	.06	.06	1.10	.8	1.37	2.9	.46	.48
i10A	-.45	.08	.98	-.1	1.04	.3	.40	.39
i11A	-.01	.06	.99	-.1	1.18	1.6	.48	.49
i12A	-.12	.07	.95	-.4	.92	-.7	.52	.46
i13A	.43	.07	.88	-1.4	.90	-1.2	.57	.52
i14A	-.10	.08	.81	-1.9	.81	-1.9	.55	.47
i15A	.23	.07	.94	-.4	1.04	.4	.56	.52
Mean	.00	.07	1.00	.0	1.15	1.2		
SD	.25	.01	.18	1.6	.31	2.5		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.5.2 Autonomy women

Item locations and fit statistics for the Autonomy scale for women are provided in Table 49. The item locations ranged from -.61 to .62 logits. Two items demonstrated underfit on both the Infit and Outfit MNSQs.

Table 49: Autonomy Item Location and Item Fit Statistics for Women: Study 2

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.62	.07	**1.48**	3.8	**1.74**	5.3	.41	.63
i2A	.16	.09	.97	-.2	1.04	.4	.52	.52
i3A	-.11	.08	1.02	.2	1.07	.6	.55	.54
I4A	-.19	.09	1.14	1.0	1.24	1.7	.46	.52
i5A	.23	.07	**1.43**	3.1	**1.95**	6.2	.38	.59
i6A	.07	.08	1.06	.5	1.30	2.1	.51	.55
i7A	-.04	.10	.81	-1.8	.78	-2.1	.65	.52
i8A	-.61	.11	.82	-1.4	.76	-1.9	.58	.43
i9A	-.18	.09	.99	.0	.99	.0	.50	.49
i10A	-.52	.10	1.02	.2	1.16	.9	.43	.43
i11A	.11	.09	.98	-.2	1.01	.1	.53	.52
i12A	-.23	.10	.69	-3.0	.66	-3.1	.69	.50
i13A	.22	.08	.93	-.6	.92	-.6	.59	.56
i14A	.48	.10	.75	-2.7	.73	-2.8	.68	.52
i15A	.00	.10	.84	-1.3	.84	-1.3	.63	.52
Mean	.00	.09	1.00	-.2	1.08			
SD	.32	.01	.22	1.8	.35			

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.5.3 Internal locus of control men

Item locations and fit statistics for the Internal locus of control scale for men are provided in Table 50. The item locations ranged from -.31 to .28 logits. One item demonstrated overfit and two items demonstrated underfit based on the Outfit MNSQs.

Table 50: Internal Locus of Control Item Location and Item Fit Statistics for Men: Study 2

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.07	.06	1.33	3.3	**1.66**	5.8	.40	.52
i2I	-.09	.07	.94	-.4	1.21	1.7	.45	.44
i3I	-.12	.06	1.02	.2	1.18	1.4	.43	.44
i4I	-.09	.07	.90	-.8	1.02	.2	.46	.42
i5I	.02	.06	1.26	2.5	**1.55**	4.0	.33	.45
i6I	-.14	.07	.92	-.6	.90	-.8	.48	.42
i7I	-.05	.07	.91	-.6	.89	-.8	.45	.40
i8I	.28	.06	.98	-.1	1.22	1.7	.47	.44
i9I	.11	.06	1.00	.0	1.12	1.1	.47	.47
i10I	-.04	.07	1.00	.0	.94	-.3	.38	.37
i11I	.27	.06	1.08	.7	1.31	2.4	.47	.47
i12I	.01	.07	.90	-.8	.93	-.6	.53	.48
i13I	.18	.06	1.03	.3	1.27	2.1	.45	.45
i14I	-.31	.08	.74	-1.6	**.60**	-2.9	.45	.34
i15I	-.12	.07	1.10	1.0	1.35	3.3	.42	.47
Mean	.00	.07	1.01	.2	1.14	1.2		
SD	.16	.01	.14	1.2	.26	2.1		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.5.4 Internal locus of control women

Item locations and fit statistics for the Internal locus of control scale for women are provided in Table 51. The item locations ranged from -.31 to .28 logits. One item demonstrated overfit and two items demonstrated underfit using Outfit MNSQs.

Table 51: Internal Locus of Control Item Location and Item Fit Statistics for Women: Study 2

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.07	.06	1.33	3.3	**1.66**	5.8	.40	.52
i2I	-.09	.07	.94	-.4	1.21	1.7	.45	.44
i3I	-.12	.06	1.02	.2	1.18	1.4	.43	.44
i4I	-.09	.07	.90	-.8	1.02	.2	.46	.42
i5I	.02	.06	1.26	2.5	**1.55**	4.0	.33	.45
i6I	-.14	.07	.92	-.6	.90	-.8	.48	.42
i7I	-.05	.07	.91	-.6	.89	-.8	.45	.40
i8I	.28	.06	.98	-.1	1.22	1.7	.47	.44
i9I	.11	.06	1.00	.0	1.12	1.1	.47	.47
i10I	-.04	.07	1.00	.0	.94	-.3	.38	.37
i11I	.27	.06	1.08	.7	1.31	2.4	.47	.47
i12I	.01	.07	.90	-.8	.93	-.6	.53	.48
i13I	.18	.06	1.03	.3	1.27	2.1	.45	.45
i14I	-.31	.08	.74	-1.6	**.60**	-2.9	.45	.34
i15I	-.12	.07	1.10	1.0	1.35	3.3	.42	.47
Mean	.00	.07	1.01	.2	1.14	1.2		
SD	.16	.01	.14	1.2	.26	2.1		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.5.5 External Locus of Control Men

Item locations and fit statistics for the External locus of control scale for men are provided in Table 52. The item locations ranged from -.61 to .46 logits. No items demonstrated overfit or underfit.

Table 52: External Locus of Control Item Location and Item Fit Statistics for Men: Study 2

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	.08	.05	.98	-.3	.95	-.5	.56	.54
i2E	.06	.05	1.01	.1	.99	.0	.56	.55
i3E	.12	.05	1.05	.6	1.16	1.6	.52	.54
i4E	.19	.05	1.04	.5	1.05	.5	.55	.55
i5E	.32	.05	.91	-1.0	1.34	3.0	.55	.53
i6E	.22	.05	.92	-.8	1.31	2.5	.53	.52
i7E	-.17	.05	.85	-2.0	.82	-2.1	.64	.57
i8E	-.61	.05	1.05	.7	1.09	1.1	.57	.60
i9E	.46	.05	1.19	1.8	1.21	1.4	.44	.49
i10E	.17	.04	1.02	.2	.98	-.2	.56	.55
i11E	-.37	.04	1.06	.8	1.09	1.0	.58	.61
i12E	-.42	.05	1.10	1.2	1.15	1.8	.55	.60
i13E	.17	.05	.93	-.8	.96	-.4	.59	.54
i14E	-.08	.04	.82	-2.4	.79	-2.6	.67	.59
i15E	-.15	.05	1.21	2.3	1.35	3.5	.43	.55
Mean	.00	.05	1.01	.1	1.08	.7		
SD	.29	.00	.11	1.3	.17	1.7		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.5.6 External Locus of Control women

Item locations and fit statistics for the External locus of control scale for women are provided in Table 53. The item locations ranged from -.69 to .55 logits. Two items demonstrated underfit based on the Outfit MNSQs.

Table 53: External Locus of Control Item Location and Item Fit Statistics for Women: Study 2

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	-.12	.07	1.10	.9	1.16	1.3	.42	.48
i2E	.21	.08	1.19	1.5	1.21	1.6	.43	.53
i3E	-.28	.07	.81	-1.9	.79	-2.0	.62	.50
i4E	.35	.07	.81	-1.6	.86	-1.0	.60	.52
i5E	.01	.06	.87	-1.1	.84	-1.2	.57	.53
i6E	.39	.08	.80	-1.5	.70	-1.9	.54	.42
i7E	-.23	.06	.99	.0	.94	-.5	.56	.55
i8E	-.69	.07	1.05	.4	1.07	.6	.55	.57
i9E	.55	.08	1.25	1.3	**1.50**	2.1	.41	.49
i10E	.43	.07	1.09	.7	1.02	.2	.50	.51
i11E	-.11	.06	1.07	.7	1.21	1.6	.51	.54
i12E	-.41	.06	1.08	.7	1.07	.6	.54	.56
i13E	.25	.07	.89	-.9	.86	-1.1	.57	.53
i14E	.05	.06	.85	-1.5	.84	-1.5	.61	.55
i15E	-.39	.06	1.31	2.5	**1.48**	3.7	.40	.54
Mean	.00	.07	1.01	.0	1.04	.2		
SD	.35	.01	.16	1.3	.23	1.6		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.6 Rasch analysis ethnicity

4.2.6.1 Autonomy Black

Item locations and fit statistics for the Autonomy scale for Black respondents are provided in Table 54. The item locations ranged from -.44 to .38 logits. Four items demonstrated underfit based on the Outfit MNSQs.

Table 54: Autonomy Item Location and Item Fit Statistics for Black Respondents: Study 2

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.38	.07	1.38	2.7	**1.83**	4.9	.40	.51
i2A	.05	.09	.97	-.1	1.13	.9	.47	.49
i3A	.03	.07	1.23	1.4	**1.94**	4.5	.36	.44
I4A	-.09	.09	1.01	.1	1.38	2.3	.41	.44
i5A	.35	.07	1.16	1.1	**1.61**	3.8	.45	.50
i6A	-.18	.10	.88	-.6	1.01	.1	.47	.40
i7A	-.20	.10	.93	-.4	.84	-1.1	.46	.42
i8A	-.44	.12	.90	-.6	.92	-.5	.42	.36
i9A	.00	.08	1.12	.8	**1.53**	2.8	.38	.42
i10A	-.22	.10	.86	-.8	.90	-.5	.39	.34
i11A	-.12	.09	.99	.0	1.08	.6	.46	.44
i12A	-.06	.09	.87	-.6	.81	-1.0	.48	.39
i13A	.27	.10	.91	-.8	.94	-.5	.54	.50
i14A	.11	.11	.90	-.9	.89	-.9	.48	.42
i15A	.11	.09	.99	.0	1.10	.7	.50	.46
Mean	.00	.09	1.01	.1	1.19	1.1		
SD	.22	.01	.15	1.0	.36	2.0		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.6.2 Autonomy White

Item locations and fit statistics for the Autonomy scale for White respondents are provided in Table 55. The item locations ranged from -.54 to .51 logits. Two items demonstrated underfit based on the Outfit MNSQs.

Table 55: Autonomy Item Location and Item Fit Statistics for White Respondents: Study 2

			Infit		Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1A	.51	.09	1.27	2.1	1.28	2.1	.57	.65
i2A	.45	.12	.99	.0	1.02	.2	.58	.58
i3A	.01	.12	.97	-.1	1.00	.0	.56	.54
I4A	-.12	.11	1.28	1.4	**1.78**	4.0	.38	.54
i5A	.42	.10	1.26	1.8	**1.46**	3.1	.51	.61
i6A	-.08	.12	.86	-1.0	.81	-1.4	.62	.55
i7A	.21	.12	.85	-1.0	.88	-.8	.58	.53
i8A	-.54	.13	.81	-1.2	.74	-1.6	.59	.47
i9A	-.24	.12	1.19	.9	1.32	1.7	.45	.50
i10A	-.51	.12	1.04	.3	1.14	.7	.45	.46
i11A	.01	.11	.90	-.7	1.06	.4	.57	.56
i12A	-.29	.11	.94	-.3	1.07	.5	.57	.52
i13A	.29	.12	.88	-.8	.91	-.7	.62	.57
i14A	-.21	.12	.78	-1.4	.80	-1.4	.65	.54
i15A	.08	.11	.97	-.1	1.01	.1	.61	.57
Mean	.00	.11	1.00	.0	1.08	.5		
SD	.32	.01	.17	1.1	.27	1.6		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.6.3 Internal locus of control Black

Item locations and fit statistics for the Internal locus of control scale for Black African respondents are provided in Table 56. The item locations ranged from -.44 to .32 logits. Two items demonstrated underfit based on the Outfit MNSQs.

Table 56: Internal Locus of Control Item Location and Item Fit Statistics for Black Respondents: Study 2

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.10	.07	1.11	.9	1.31	2.0	.43	.47
i2I	.03	.08	.96	-.2	1.38	2.1	.40	.41
i3I	.08	.07	1.09	.6	1.29	1.3	.35	.37
i4I	-.11	.10	.90	-.6	.90	-.6	.42	.37
i5I	-.36	.10	1.10	.8	1.34	1.6	.28	.34
i6I	-.02	.08	.88	-.6	.81	-1.0	.44	.38
i7I	.06	.09	.88	-.5	.97	.0	.37	.35
i8I	.20	.07	1.02	.2	1.36	1.7	.39	.37
i9I	.05	.08	1.00	.1	1.14	.9	.43	.43
i10I	-.11	.09	.86	-.6	.77	-1.1	.38	.33
i11I	.32	.07	1.27	1.5	**1.82**	3.9	.36	.42
i12I	.22	.10	.95	-.4	.99	-.1	.48	.46
i13I	.04	.09	1.14	.9	**1.42**	2.4	.38	.43
i14I	-.44	.13	.82	-.7	.66	-1.6	.37	.27
i15I	-.08	.09	1.08	.6	1.25	1.6	.38	.40
Mean	.00	.09	1.00	.1	1.16	.9		
SD	.19	.02	.12	.7	.30	1.5		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.6.4 Internal locus of control White

Item locations and fit statistics for the Internal locus of control scale for White respondents are provided in Table 57. The item locations ranged from -.31 to .62 logits. Three items demonstrated underfit, one based on both the Infit and Outfit MNSQs, but the other two only on the Outfit MNSQs.

Table 57: Internal Locus of Control Item Location and Item Fit Statistics for White Respondents: Study 2

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1I	.40	.10	1.49	3.1	**1.69**	4.2	.36	.58
i2I	-.27	.13	.80	-1.2	.71	-1.9	.56	.45
i3I	-.12	.10	1.06	.5	1.26	1.3	.45	.50
i4I	-.20	.11	1.05	.3	**1.52**	2.2	.43	.46
i5I	.38	.10	**1.42**	2.6	**1.63**	3.7	.39	.57
i6I	-.31	.14	.82	-1.4	.71	-1.9	.56	.44
i7I	-.14	.13	.71	-1.7	.61	-2.4	.59	.43
i8I	-.06	.10	.91	-.3	1.03	.2	.53	.46
i9I	.15	.10	1.09	.6	1.18	1.0	.47	.49
i10I	-.31	.13	1.02	.2	1.03	.3	.44	.45
i11I	.01	.10	.99	.1	1.27	1.4	.52	.48
i12I	-.13	.12	.76	-1.9	.73	-2.0	.63	.51
i13I	.00	.09	1.06	.4	1.20	1.1	.50	.50
i14I	-.04	.15	.76	-2.2	.65	-2.2	.57	.40
i15I	.62	.12	1.09	.8	1.35	2.5	.47	.53
Mean	.00	.11	1.00	.0	1.10	.5		
SD	.27	.02	.22	1.5	.35	2.1		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.6.5 External Locus of Control Black

Item locations and fit statistics for the External locus of control scale for Blacks are provided in Table 58. The item locations ranged from -.52 to .34 logits. One item demonstrated underfit based on the Outfit MNSQ.

Table 58: External Locus of Control Item Location and Item Fit Statistics for Black Respondents: Study 2

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	.16	.06	1.01	.1	1.11	.9	.49	.51
i2E	.08	.06	.93	-.5	.89	-.8	.57	.52
i3E	.23	.06	.94	-.4	.85	-1.1	.55	.50
i4E	.04	.06	1.14	1.3	1.17	1.3	.49	.55
i5E	.26	.06	.87	-1.0	**1.70**	3.9	.54	.51
i6E	.28	.06	.95	-.4	1.04	.3	.53	.50
i7E	-.16	.06	.97	-.3	.92	-.7	.58	.54
i8E	-.52	.06	.88	-1.2	.88	-1.1	.63	.57
i9E	.34	.06	1.06	.4	1.05	.3	.48	.48
i10E	.21	.06	.98	-.1	.88	-.8	.54	.51
i11E	-.43	.05	1.10	1.0	1.15	1.3	.54	.60
i12E	-.41	.06	1.15	1.4	1.26	2.2	.47	.57
i13E	.13	.06	1.06	.6	1.09	.8	.52	.53
i14E	-.01	.06	.85	-1.5	.80	-1.9	.65	.57
i15E	-.21	.06	1.24	2.0	1.37	2.7	.39	.53
Mean	.00	.06	1.01	.1	1.08	.5		
SD	.27	.00	.11	1.0	.23	1.6		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.6.6 External Locus of Control White

Item locations and fit statistics for the External locus of control scale are provided in Table 59. The item locations ranged from -.99 to .57 logits. No items demonstrated overfit or underfit.

Table 59: External Locus of Control Item Location and Item Fit Statistics for White Respondents: Study 2

		Infit			Outfit		PT-Measure	
Item	Measure	SE	MNSQ	Z	MNSQ	Z	Corr	Exp
i1E	-.01	.08	1.01	.1	.96	-.2	.58	.55
i2E	.15	.08	1.15	1.2	1.14	1.1	.49	.55
i3E	.01	.08	.97	-.2	1.27	1.8	.56	.55
i4E	.39	.08	.83	-1.2	.77	-1.4	.61	.52
i5E	.16	.07	.93	-.4	.92	-.4	.58	.55
i6E	.30	.08	.72	-1.9	1.25	1.4	.57	.50
i7E	-.25	.07	.92	-.6	.90	-.8	.60	.58
i8E	-.99	.08	1.21	1.6	1.22	1.6	.53	.62
i9E	.57	.09	1.17	1.0	1.26	1.1	.42	.46
i10E	.19	.08	1.17	1.2	1.26	1.4	.51	.54
i11E	-.11	.07	1.05	.5	1.09	.7	.55	.59
i12E	-.40	.07	1.25	2.0	1.22	1.7	.53	.62
i13E	.31	.08	.75	-1.9	.69	-2.2	.64	.52
i14E	-.14	.08	.95	-.4	.92	-.6	.62	.59
i15E	-.17	.08	1.08	.6	1.20	1.4	.53	.57
Mean	.00	.08	1.01	.1	1.07	.4		
SD	.37	.00	.16	1.2	.19	1.2		

Note. IMNSQ and OMNSQ ≥ 1.4 or ≤ .60 in bold.

4.2.7 Construct validity

Construct validity of the three-factor model was investigated using confirmatory factor analysis with robust maximum likelihood estimation (Satorra & Bentler, 1988a, 1988b). The fit statistics for the three factor model were: robust χ^2 (942) = 1638.954, $p < .001$, CFI = .825, TLI = .816, RMSEA = .041 (.038 - .044), SRMR = .067). However, the baseline RMSEA was < .158 and therefore the CFI and TLI may not be informative (Kenny, 2015). All of the factor loadings were statistically significant. The R^2 values ranged from .04 to .45. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .746, Autonomy and External locus of control = -.391, and Internal locus of control and External locus of control = -.449. The unstandardised and standardised factor loadings are provided in Table 60. The same procedures described in Study 1 were used to evaluate convergent and discriminant validity of the scales. The convergent/discriminant validity coefficients again indicated evidence for discriminant validity between the scales, but that there Autonomy and Internal locus of control scales were closely related.

Table 60: Unstandardised and Standardised Factor Loadings: Study 2

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.55	.08	7.08	< .001	.35	.12
i2A	.55	.05	1.94	< .001	.52	.27
i3A	.50	.06	8.64	< .001	.43	.18
I4A	.38	.06	6.41	< .001	.36	.13
i5A	.59	.07	8.66	< .001	.44	.19
i6A	.64	.06	11.07	< .001	.57	.33
i7A	.59	.05	13.11	< .001	.60	.36
i8A	.44	.04	11.70	< .001	.57	.32
i9A	.46	.05	8.93	< .001	.43	.18

i10A	.36	.04	8.10	< .001	.40	.16
i11A	.56	.05	1.53	< .001	.51	.26
i12A	.67	.04	15.63	< .001	.65	.42
i13A	.64	.05	13.51	< .001	.61	.37
i14A	.62	.04	16.61	< .001	.67	.44
i15A	.59	.05	13.29	< .001	.58	.33
i1I	.24	.06	3.93	< .001	.20	.04
i2I	.50	.04	11.12	< .001	.51	.26
i3I	.56	.06	9.93	< .001	.45	.20
i4I	.43	.04	11.03	< .001	.48	.23
i5I	.30	.06	5.10	< .001	.26	.07
i6I	.55	.04	13.43	< .001	.58	.34
i7I	.50	.04	12.02	< .001	.55	.30
i8I	.60	.05	11.11	< .001	.50	.25
i9I	.45	.06	7.62	< .001	.38	.15
i10I	.38	.05	7.63	< .001	.42	.17
i11I	.50	.06	8.80	< .001	.40	.16
i12I	.54	.04	13.87	< .001	.56	.31
i13I	.37	.06	6.21	< .001	.33	.11
i14I	.43	.04	12.33	< .001	.61	.37
i15I	.52	.04	11.72	< .001	.52	.27
i1E	.72	.07	9.83	< .001	.51	.26
i2E	.72	.08	9.38	< .001	.49	.24
i3E	.81	.08	9.68	< .001	.53	.29
i4E	.87	.08	11.25	< .001	.57	.32
i5E	.94	.08	12.01	< .001	.60	.36
i6E	.89	.09	1.37	< .001	.60	.36
i7E	1.00	.07	14.14	< .001	.62	.38
i8E	.77	.07	1.53	< .001	.51	.26

i9E	.54	.08	6.79	< .001	.39	.15
i10E	.86	.08	1.19	< .001	.54	.29
i11E	.99	.08	12.03	< .001	.54	.29
i12E	.82	.07	11.10	< .001	.50	.25
i13E	.89	.07	12.44	< .001	.59	.35
i14E	1.11	.07	16.77	< .001	.67	.45
i15E	.57	.08	7.25	< .001	.38	.14

4.2.8 Construct validity Men

The fit statistics for the three factor model for men were: robust χ^2 (942) = 1433.909, p < .001, CFI = .810, TLI = .801, RMSEA = .043 (.039 - .047), SRMR = .077). However, the baseline RMSEA was < .158 and therefore the CFI and TLI may not be informative (Kenny, 2015). All of the factor loadings were statistically significant. The R^2 values ranged from .05 to .47. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .793, Autonomy and External locus of control = -.420, and Internal locus of control and External locus of control = -.428. The average variance extracted for each factor was: Autonomy = .246, Internal locus of control = .193, and External locus of control = .315. The unstandardised and standardised factor loadings are provided in Table 61. Convergent/discriminant validity coefficients painted a similar picture for men as for the combined sample.

Table 61: Unstandardised and Standardised Factor Loadings for Men: Study 2

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.52	.09	5.55	< .001	.34	.12
i2A	.55	.06	9.20	< .001	.52	.27
i3A	.43	.08	5.36	< .001	.37	.13
I4A	.34	.08	4.36	< .001	.35	.12

i5A	.69	.08	8.59	< .001	.52	.27
i6A	.59	.06	1.77	< .001	.63	.40
i7A	.55	.06	8.56	< .001	.56	.32
i8A	.45	.05	8.53	< .001	.58	.33
i9A	.45	.07	6.68	< .001	.41	.17
i10A	.34	.06	6.23	< .001	.40	.16
i11A	.56	.07	8.58	< .001	.51	.26
i12A	.65	.06	11.23	< .001	.62	.38
i13A	.56	.06	1.17	< .001	.59	.34
i14A	.56	.05	11.74	< .001	.62	.39
i15A	.56	.06	9.60	< .001	.53	.28
i1I	.27	.08	3.32	.001	.21	.05
i2I	.53	.06	9.14	< .001	.52	.27
i3I	.52	.06	9.10	< .001	.45	.20
i4I	.47	.04	1.79	< .001	.52	.27
i5I	.27	.07	3.70	< .001	.24	.06
i6I	.58	.06	1.47	< .001	.57	.32
i7I	.50	.05	9.38	< .001	.53	.28
i8I	.63	.07	8.59	< .001	.49	.24
i9I	.43	.06	7.07	< .001	.41	.16
i10I	.34	.07	4.81	< .001	.35	.12
i11I	.54	.07	8.36	< .001	.44	.19
i12I	.50	.05	9.41	< .001	.51	.26
i13I	.42	.07	5.84	< .001	.36	.13
i14I	.43	.05	9.48	< .001	.60	.37
i15I	.43	.06	7.68	< .001	.45	.20
i1E	.82	.09	8.97	< .001	.56	.32
i2E	.86	.09	9.18	< .001	.55	.30
i3E	.81	.11	7.23	< .001	.52	.27

i4E	.87	.10	8.64	< .001	.53	.28
i5E	.97	.10	9.78	< .001	.61	.37
i6E	.91	.11	8.10	< .001	.57	.33
i7E	1.10	.09	12.50	< .001	.67	.45
i8E	.83	.09	9.27	< .001	.54	.29
i9E	.64	.10	6.61	< .001	.42	.18
i10E	.97	.11	8.93	< .001	.57	.33
i11E	1.03	.10	1.32	< .001	.56	.31
i12E	.84	.09	9.19	< .001	.51	.26
i13E	.92	.09	9.87	< .001	.60	.36
i14E	1.17	.08	13.96	< .001	.68	.47
i15E	.65	.10	6.54	< .001	.43	.19

4.2.9 Construct validity women

The fit statistics for the three factor model for women were: robust χ^2 (942) = 1410.500, $p < .001$, CFI = .740, TLI = .727, RMSEA = .057 (.051 - .063), SRMR = .083). However, the baseline RMSEA was < .158 and therefore the CFI and TLI may not be informative (Kenny, 2015). One factor loading was not statistically significant. The R^2 values ranged from .03 to .52. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .720, Autonomy and External locus of control = -.487, and Internal locus of control and External locus of control = -.527. The average variance extracted for each factor was: Autonomy = .253, Internal locus of control = .211, and External locus of control = .258. The unstandardised and standardised factor loadings are provided in Table 62. Convergent/discriminant validity coefficients painted a similar picture for women as for the combined sample.

Table 62: Unstandardised and Standardised Factor Loadings for Women: Study 2

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.45	.13	3.63	< .001	.29	.09
i2A	.49	.09	5.65	< .001	.48	.23
i3A	.60	.07	8.21	< .001	.52	.27
I4A	.41	.09	4.85	< .001	.37	.14
i5A	.42	.12	3.40	.001	.32	.10
i6A	.65	.12	5.38	< .001	.50	.25
i7A	.62	.06	1.08	< .001	.64	.41
i8A	.47	.05	9.69	< .001	.60	.36
i9A	.48	.07	6.44	< .001	.47	.22
i10A	.37	.07	5.03	< .001	.39	.15
i11A	.53	.08	6.33	< .001	.50	.25
i12A	.68	.07	9.92	< .001	.71	.50
i13A	.68	.08	8.31	< .001	.59	.35
i14A	.67	.06	11.73	< .001	.72	.52
i15A	.62	.07	9.25	< .001	.66	.43
i1I	.21	.09	2.31	.021	.18	.03
i2I	.44	.07	6.36	< .001	.49	.24
i3I	.61	.12	5.07	< .001	.45	.20
i4I	.38	.07	5.20	< .001	.43	.18
i5I	.37	.09	3.89	< .001	.31	.10
i6I	.51	.06	8.74	< .001	.62	.39
i7I	.50	.07	7.75	< .001	.60	.36
i8I	.56	.07	8.49	< .001	.54	.29
i9I	.49	.12	3.98	< .001	.36	.13
i10I	.44	.05	8.87	< .001	.58	.34

i11I	.45	.10	4.34	< .001	.36	.13
i12I	.63	.05	11.92	< .001	.67	.44
i13I	.27	.10	2.57	.010	.24	.06
i14I	.43	.05	8.18	< .001	.64	.41
i15I	.66	.06	1.44	< .001	.64	.41
i1E	.52	.11	4.58	< .001	.39	.15
i2E	.39	.13	3.05	.002	.31	.10
i3E	.88	.09	9.38	< .001	.64	.41
i4E	.80	.11	7.24	< .001	.63	.39
i5E	.93	.13	7.28	< .001	.61	.37
i6E	.78	.11	7.17	< .001	.64	.41
i7E	.83	.11	7.75	< .001	.54	.29
i8E	.64	.13	5.03	< .001	.45	.20
i9E	.21	.12	1.84	.066	.20	.04
i10E	.52	.10	5.20	< .001	.41	.17
i11E	.77	.14	5.52	< .001	.47	.22
i12E	.73	.13	5.71	< .001	.47	.22
i13E	.84	.10	8.09	< .001	.59	.35
i14E	.98	.11	8.96	< .001	.63	.39
i15E	.46	.13	3.66	< .001	.30	.09

4.2.10 Construct validity Black

The fit statistics for the three factor model for Black respondents were: robust χ^2 (942) = 1240.981, $p < .001$, CFI = .744, TLI = .731, RMSEA = .046 (.039 - .052), SRMR = .090). However, the baseline RMSEA was < .158 and therefore the CFI and TLI may not be informative (Kenny, 2015). One factor loading was not statistically significant. The R^2 values ranged from .03 to .42. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .777, Autonomy and External locus of control = -.338, and Internal locus of control and External locus of control =

-.381. The average variance extracted for each factor was: Autonomy = .195, Internal locus of control = .144, and External locus of control = .268. The unstandardised and standardised factor loadings are provided in Table 63. Convergent/discriminant validity coefficients painted a similar picture for Black respondents as for the combined sample.

Table 63: Unstandardised and Standardised Factor Loadings For Black Respondents: Study 2

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.46	.15	3.14	.002	.29	.09
i2A	.49	.09	5.52	< .001	.46	.22
i3A	.39	.14	2.79	.005	.29	.09
I4A	.36	.10	3.75	< .001	.37	.14
i5A	.60	.15	3.99	< .001	.42	.17
i6A	.54	.09	6.19	< .001	.57	.32
i7A	.53	.09	5.94	< .001	.54	.29
i8A	.33	.05	6.14	< .001	.48	.23
i9A	.41	.09	4.41	< .001	.36	.13
i10A	.40	.08	4.81	< .001	.49	.24
i11A	.43	.08	5.56	< .001	.42	.18
i12A	.63	.08	7.60	< .001	.60	.36
i13A	.57	.08	7.36	< .001	.57	.33
i14A	.43	.07	6.40	< .001	.54	.29
i15A	.49	.09	5.79	< .001	.45	.20
i1I	.39	.12	3.20	.001	.30	.09
i2I	.48	.08	6.03	< .001	.43	.18
i3I	.41	.09	4.42	< .001	.33	.11
i4I	.40	.06	6.89	< .001	.50	.25
i5I	.16	.09	1.89	.059	.18	.03

i6I	.60	.09	7.00	< .001	.55	.30
i7I	.38	.09	4.25	< .001	.38	.15
i8I	.47	.10	4.56	< .001	.38	.14
i9I	.38	.11	3.51	< .001	.34	.12
i10I	.38	.09	4.42	< .001	.42	.17
i11I	.42	.12	3.58	< .001	.29	.09
i12I	.49	.07	7.15	< .001	.51	.26
i13I	.28	.11	2.57	.010	.26	.07
i14I	.28	.05	6.03	< .001	.47	.22
i15I	.39	.08	5.25	< .001	.40	.16
i1E	.72	.13	5.43	< .001	.49	.24
i2E	.87	.14	6.07	< .001	.55	.30
i3E	.83	.15	5.69	< .001	.54	.30
i4E	.76	.16	4.81	< .001	.43	.18
i5E	.98	.16	6.01	< .001	.59	.35
i6E	.88	.15	5.88	< .001	.55	.31
i7E	.88	.13	6.97	< .001	.55	.30
i8E	.97	.12	8.17	< .001	.59	.35
i9E	.78	.17	4.74	< .001	.48	.23
i10E	.91	.16	5.76	< .001	.55	.30
i11E	.91	.15	6.19	< .001	.48	.23
i12E	.74	.14	5.25	< .001	.44	.19
i13E	.72	.14	5.14	< .001	.45	.20
i14E	1.17	.13	8.93	< .001	.65	.42
i15E	.56	.14	3.98	< .001	.35	.12

4.2.11 Construct validity White

The fit statistics for the three factor model for White respondents were: robust χ^2 (942) = 1331.030, $p < .001$, CFI = .773, TLI = .762, RMSEA = .058 (.051 - .064), SRMR = .085). However, the baseline RMSEA was < .158 and therefore the CFI and TLI may not be informative (Kenny, 2015). One factor loading was not statistically significant. The R^2 values ranged from .03 to .53. The inter-factor correlation coefficients were: Autonomy and Internal locus of control = .798, Autonomy and External locus of control = -.628, and Internal locus of control and External locus of control = -.575. The average variance extracted for each factor was: Autonomy = .304, Internal locus of control = .234, and External locus of control = .326. The unstandardised and standardised factor loadings are provided in Table 64. Convergent/discriminant validity coefficients painted a similar picture for White respondents as for the combined sample.

Table 64: Unstandardised and Standardised Factor Loadings for White Respondents: Study 2

Item	Unstandardised Estimate	SE	Z-Value	*p*	Standardised Estimate	R^2
i1A	.67	.11	6.16	< .001	.50	.25
i2A	.49	.08	6.52	< .001	.54	.29
i3A	.52	.07	7.52	< .001	.55	.30
I4A	.30	.13	2.40	.017	.31	.10
i5A	.53	.10	5.22	< .001	.45	.21
i6A	.63	.07	8.91	< .001	.66	.44
i7A	.56	.09	6.52	< .001	.63	.40
i8A	.53	.05	9.97	< .001	.67	.45
i9A	.33	.07	4.48	< .001	.36	.13
i10A	.42	.08	4.99	< .001	.48	.23
i11A	.66	.09	7.42	< .001	.63	.39
i12A	.58	.07	8.97	< .001	.61	.37

i13A	.56	.06	8.83	< .001	.59	.35
i14A	.63	.06	1.17	< .001	.69	.48
i15A	.58	.08	7.71	< .001	.60	.36
i1I	.21	.10	2.18	.029	.19	.03
i2I	.51	.07	6.96	< .001	.65	.42
i3I	.43	.08	5.10	< .001	.40	.16
i4I	.45	.08	6.09	< .001	.46	.21
i5I	.22	.11	1.91	.056	.18	.03
i6I	.51	.07	7.88	< .001	.69	.47
i7I	.57	.06	9.57	< .001	.70	.49
i8I	.58	.09	6.55	< .001	.58	.33
i9I	.44	.09	5.15	< .001	.39	.15
i10I	.25	.07	3.62	< .001	.30	.09
i11I	.54	.07	7.41	< .001	.54	.29
i12I	.66	.07	9.60	< .001	.71	.50
i13I	.48	.11	4.37	< .001	.41	.17
i14I	.44	.05	8.86	< .001	.69	.47
i15I	.48	.07	6.46	< .001	.53	.29
i1E	.74	.13	5.97	< .001	.54	.29
i2E	.69	.11	6.03	< .001	.51	.26
i3E	.84	.14	5.83	< .001	.60	.35
i4E	.91	.12	7.51	< .001	.67	.44
i5E	.99	.13	7.47	< .001	.64	.41
i6E	.93	.16	5.91	< .001	.69	.47
i7E	.97	.12	8.38	< .001	.63	.40
i8E	.61	.12	5.04	< .001	.44	.19
i9E	.56	.12	4.74	< .001	.45	.20
i10E	.76	.12	6.53	< .001	.49	.24
i11E	.88	.14	6.22	< .001	.56	.32

i12E	.68	.12	5.62	< .001	.43	.19
i13E	.96	.11	8.64	< .001	.73	.53
i14E	.88	.11	8.09	< .001	.59	.35
i15E	.72	.13	5.74	< .001	.52	.27

4.2.12 Measurement invariance

The same approach as described for Study 1 was used to investigate measurement invariance of the LCI scales across gender and ethnicity. The results indicated that metric equivalence was tenable for both gender and ethnicity. Because the full three factor model had a baseline RMSEA < .158 measurement invariance was further investigated one each factor individually. The results for gender indicated that metric equivalence was viable for all three factors. For ethnicity Autonomy demonstrated scalar invariance while Internal and External locus of control demonstrated metric invariance. As with study 1, partial-measurement invariance was not investigated.

Table 65: Measurement Invariance for Gender: Study 2

Model	χ^2	*df*	*p*	CFI	RMSEA
Model 1: Configural	2846.045	1884	< .001	.783	.049
Model 2: Metric	2898.918	1926	< .001	.781	.048
Model 3: Scalar	3059.484	1968	< .001	.754	.051
Model 4: Strict	3216.269	2013	< .001	.729	.053
	Δ χ^2	Δ *df*	*P*	Δ CFI	
Model 1 vs. Model 2	50.15	42	.182	**.002**	
Model 2 vs. Model 3	973.92	42	< .001	**.**027	
Model 3 vs. Model 4	141.03	45	< .001	.025	

Note. Δ CFI < .01 in bold.

Table 66: Measurement Invariance for Ethnicity: Study 2

Model	χ^2	*df*	*p*	CFI	RMSEA
Model 1: Configural	2568.092	1884	< .001	.761	.051
Model 2: Metric	2610.363	1926	< .001	.761	.051
Model 3: Scalar	2781.813	1968	< .001	.716	.055
Model 4: Strict	2918.990	2013	< .001	.683	.057
	Δ χ^2	Δ *df*	*P*	Δ CFI	
Model 1 vs. Model 2	39.63	42	.575	**.000**	
Model 2 vs. Model 3	.*	.	.	.045	
Model 3 vs. Model 4	90.05	45	<. 001	.032	

Note. Δ CFI < .01 in bold. * Scaling factor negative.

4.2.13 Differential item functioning

Uniform and non-uniform DIF was investigated using the same procedure as described in Study 1. The results for gender indicate that no items displayed statistically significant uniform or non-uniform DIF. For ethnicity two items demonstrated statistically significant uniform DIF. However, only one item had practically significant DIF.

Table 67: Uniform and Non-Uniform DIF by Gender: Study 2

Item	Uniform			Non-Uniform DIF	
	F	*p*	Contrast	*F*	*p*
i1A	**15.281**	.000	.23	1.487	.205
i2A	1.192	.276	.08	1.611	.171
i3A	1.203	.273	-.10	2.158	.073
I4A	.293	.589	-.06	.845	.497
i5A	.000	.989	-.12	1.093	.360

i6A	**13.840**	.000	.38	.266	.900
i7A	.007	.933	.10	.726	.575
i8A	**11.410**	.001	-.30	2.004	.093
i9A	6.888	.009	-.32	.386	.819
i10A	.544	.461	-.09	.869	.482
i11A	.073	.788	-.07	.246	.912
i12A	5.803	.016	-.13	.574	.681
i13A	.267	.605	.13	.325	.861
i14A	.014	.906	.10	.370	.830
i15A	.722	.396	-.06	1.425	.225
i1I	.723	.396	.03	1.597	.174
i2I	2.037	.154	-.20	.308	.873
i3I	.266	.606	.07	.602	.661
i4I	5.339	.021	-.31	1.616	.169
i5I	4.902	.027	.28	.798	.527
i6I	.279	.597	-.09	.918	.453
i7I	1.723	.190	-.12	.195	.941
i8I	1.466	.227	-.13	.404	.806
i9I	2.176	.141	.17	.084	.987
i10I	.017	.898	.02	1.787	.130
i11I	.133	.716	.00	1.022	.396
i12I	5.347	.021	-.21	1.310	.265
i13I	.128	.721	-.03	3.976	.004
i14I	1.219	.270	.10	2.838	.024
i15I	1.429	.233	.23	1.993	.095
i1E	.198	.656	.03	.486	.746
i2E	.585	.445	.06	2.311	.057
i3E	5.277	.022	-.24	3.170	.014
i4E	1.582	.209	.11	1.177	.320

i5E	6.176	.013	-.19	2.212	.067
i6E	5.028	.025	.19	2.642	.033
i7E	4.058	.045	-.15	.273	.895
i8E	1.546	.214	-.08	.504	.733
i9E	1.143	.286	.11	.683	.604
i10E	5.556	.019	.19	.444	.777
i11E	7.679	.006	.24	2.548	.039
i12E	.010	.922	.00	.514	.726
i13E	.069	.793	.00	.723	.577
i14E	1.519	.219	-.06	.437	.782
i15E	2.278	.132	.03	1.171	.323

Note. Bonferroni *p* value = .003.

Table 68: Uniform and Non-Uniform DIF by Ethnicity: Study 2

Item	Uniform			Non-Uniform DIF	
	F	*p*	Contrast	*F*	*p*
i1A	.437	.509	-.02	1.225	.301
i2A	.304	.582	-.08	1.551	.188
i3A	2.146	.144	.23	1.597	.175
I4A	.844	.359	-.06	.893	.469
i5A	.021	.886	.05	.754	.556
i6A	.287	.593	-.15	1.816	.126
i7A	4.289	.039	-.24	1.845	.121
i8A	1.735	.189	.06	1.186	.317
i9A	.218	.641	.13	.600	.663
i10A	.153	.696	.05	.803	.524
i11A	.226	.635	.07	1.474	.210
i12A	.002	.961	.00	.572	.683

i13A	3.897	.049	.23	.733	.570
i14A	.067	.796	-.16	2.243	.065
i15A	1.711	.192	-.18	.165	.956
i1I	5.753	.017	-.15	3.426	.009
i2I	8.319	.004	.37	.725	.576
i3I	.218	.641	.00	.361	.836
i4I	.053	.819	.00	.342	.849
i5I	38.525	**.000**	-.80	.696	.595
i6I	7.057	.008	.34	1.486	.207
i7I	3.425	.065	.13	.239	.916
i8I	.513	.475	.08	.739	.566
i9I	1.016	.314	.12	.792	.531
i10I	.477	.490	-.06	.968	.425
i11I	3.016	.084	.23	1.065	.374
i12I	6.643	.010	.26	.775	.542
i13I	.375	.541	.00	1.099	.357
i14I	.903	.343	-.30	.657	.623
i15I	4.709	.031	-.31	.215	.930
i1E	1.122	.291	.12	1.446	.219
i2E	2.931	.088	.13	.866	.485
i3E	7.800	.006	.27	1.288	.275
i4E	8.548	.004	-.26	1.118	.348
i5E	1.692	.195	.17	1.360	.248
i6E	.002	.969	.00	1.399	.235
i7E	.175	.676	-.05	1.200	.311
i8E	4.550	.034	.23	3.210	.013
i9E	.033	.855	-.05	.757	.554
i10E	.551	.459	.06	.393	.814
i11E	16.847	**.000**	-.36	1.680	.155

i12E	.402	.526	.00	.651	.626
i13E	5.222	.023	-.23	.758	.553
i14E	.913	.340	.07	1.211	.306
i15E	.002	.969	.02	.640	.635

Note. Bonferroni *p* value = .003.

4.2.14 Differential test functioning

The combined effect of DIF across each scale was investigated using the same procedure as in Study 1. The results are presented in Table 69. The results indicate minimal differential test functioning across the Autonomy and Internal locus of control scales for gender. For ethnicity, the Autonomy scale demonstrated minimal evidence of differential test functioning. The External scale demonstrated medium to large differential test functioning, while the Internal locus of control scale demonstrated large differential test functioning.

Table 69: Differential Test Functioning: Study 1

Scale	Gender v^2	Ethnicity v^2
Autonomy	.01	.01
Internal locus of control	.05	.25
External locus of control	.09	.15

4.2.15 Correlation coefficients

Pearson correlation coefficients and Spearman-rho rank order correlation coefficients for the LCI 5th edition scales are reported in Table 70. Inspection of the non-parametric Loess regression lines (Cleveland, 1979) indicated that for the most part the relationships between the variables were linear. Inspection of multivariate normality using Mardia's coefficient (Mardia, 1970) and

contour plots found that bivariate normality was not met across the three scales. The correlation coefficients had medium to large effect sizes (Cohen, 1988).

Table 70: Pearson and Spearman-Rho Rank Order Correlations: Study 2

	Autonomy	Internal LOC	External LOC
Autonomy	.	.59***	-.39***
Internal LOC	.60***	.	-.37***
External LOC	-.36***	-.34***	.

Note. Pearson correlations below the diagonal, Spearman rho rank-order correlations above the diagonal. *** = $p < .001$.

4.2.16 Mean score differences for Gender

Differences in group centroids for Gender were investigated using Hoteling's T^2 test (caution must be used with interpretation of group differences because scalar invariance was not demonstrated). The results indicate that there was a statistically significant difference in the group centroids between men and women [$T^2(3, 426) = 16.569$, $p < .001$]. Post-hoc independent samples *t* tests with a Holm-Bonferroni correction were subsequently applied. The results indicated that there were statistically significant differences in the means for men and women on the Autonomy [*M* men = 88.44, SD = 8.62, *M* women = 84.58, SD = 8.98, $t(428) = -4.387$, $p_{adj} = .000$, $d = .44$] and External locus of control [*M* men = 45.53, SD = 14.37, *M* women = 41.76, SD = 11.34, $t(377.50) = -2.990$, $p_{adj} = .006$, $d = 1.02$] scales. There was no difference in the means for the Internal locus of control [*M* men = 45.53, SD = 14.37, *M* women = 41.76, SD = 11.34, $t(428) = -2.40$, $p_{adj} = .810$].

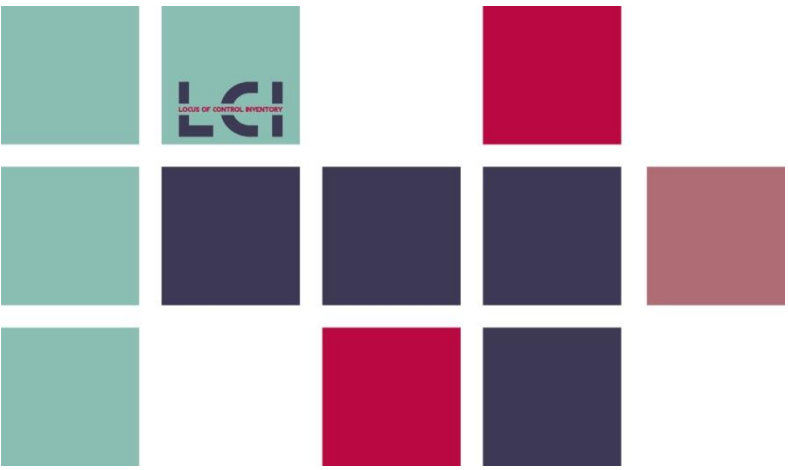
4.2.17 Mean score differences for Ethnicity

Differences in group centroids for Ethnicity were investigated using Hoteling's T^2 test (caution must be used with interpretation of group differences because scalar invariance was not demonstrated). The results indicate that there was a statistically significant difference in the group centroids between Black and White respondents [$T^2(3, 272) = 5.299$, $p = .001$]. Post-hoc independent samples *t* tests with a Holm-Bonferroni correction were subsequently applied. The results indicated that there were no statistically significant differences in the means for Black and White respondents on the three LCI 5th edition scales: Autonomy = [*M* Black = 89.75, SD = 8.00, *M* White = 87.48, SD = 8.67, $t(274) = 2.256$, $p_{adj} = .075$, $d = .27$], Internal locus of control = [*M* Black = 92.99, SD = 7.050, *M* White = 91.31, SD = 7.661, $t(274) = 1.867$, $p_{adj} = .116$, $d = .23$], and External locus of control = [*M* Black = 45.26, SD = 13.879, *M* White = 42.21, SD = 12.995, $t(274) = 1.902$, $p_{adj} = .116$, $d = .23$].

4.2.18 Summary

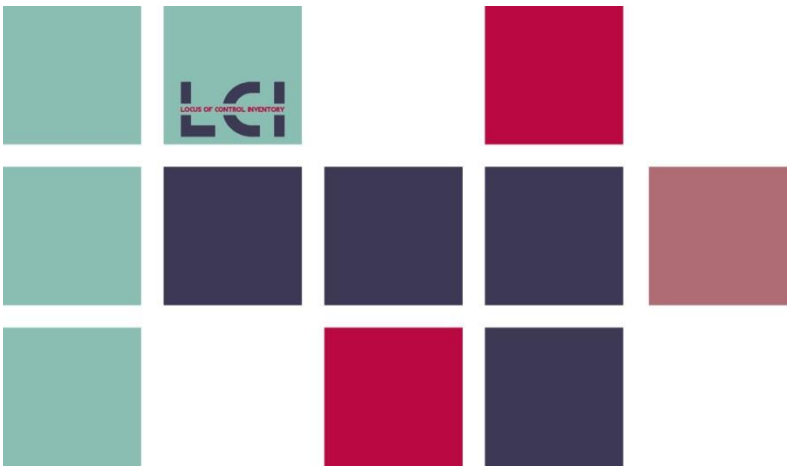
As with Study 1, the LCI appears to have acceptable reliability across gender and ethnic groups. The three-factor structure was again supported by the factor analysis, and the factors appear to be mostly unidimensional. Few items demonstrated underfit using the Infit MNSQ measure. There were one or two items that were somewhat problematic across both sample groups. These items are flagged for further research. As previously stated, cross-validation studies are required before definitive conclusions can be reached. For the most part there was little evidence of DIF across gender and ethnicity. However, there was some evidence of DTF on the Internal and External scales across ethnicity. In Study 1 the Internal scale also demonstrated large DTF. This means that caution should be used when comparing scores across ethnic groups because the metric is not the same (that is, group differences in scores may indicate a different metric rather than real group differences). The mean score differences across groups were generally small, except for the External locus of control scale for men and women. Because this result did not occur in Study 1, it is necessary that further research is done before making any definitive

conclusions. As previously stated, caution should be used when comparing scale scores across gender.



5. Comparison of norm scores

The LCI 4th edition norm scores for each respondent were compared to the LCI 5th edition norm scores. It is important to note that the norm scores are based on two different sample groups and therefore they will not be identical. Pearson's correlation coefficient was used to investigate the similarity between the two norm scores. The correlation coefficients were: Autonomy = .91, Internal locus of control = .90, and External locus of control = .93. As a whole the norm scores remained fairly consistent from the LCI 4th edition to the LCI 5th edition.

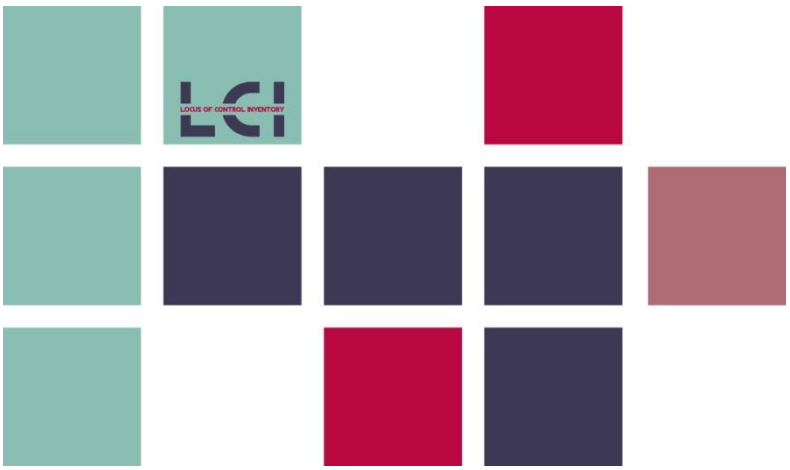


6. Frequency of profile scores

In this section the frequency of scores that are high and low on the Internal locus of control and External locus of control scales is presented. It would be expected that few respondents scored low or high on both these scales (Levenson, 1981). Three categories were created (low, average, and high) based on the standard deviations of the stanine norm scores. Inspection of Table 71 indicates that few respondents scored low or high on both the Internal and External locus of control scales (*n* = 53, 4.86%) while 195 (17.89%) of the respondents score high/low and low/high on the two scales. For the most part the respondents scored average on both scales (*n* = 355, 32.57%).

Table 71: Comparison of Norm Scores on the Internal and External Locus of Control Scales

	Count	Percent
Low External – Low Internal	18	1.65
Low External – Average Internal	106	9.72
Low External – High Internal	105	9.63
Average External – Low Internal	136	12.48
Average External – Average Internal	355	32.57
Average External – High Internal	109	9.91
High External – Low Internal	90	8.26
High External – Average Internal	137	12.57

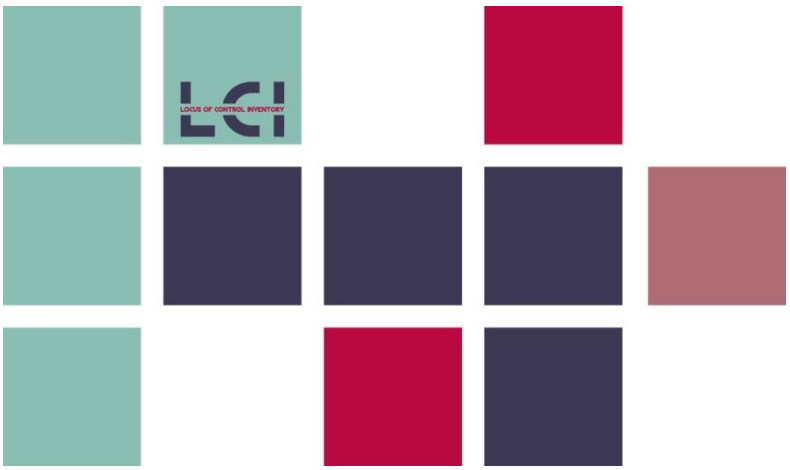


High External – High Internal	35	3.21

7. R packages

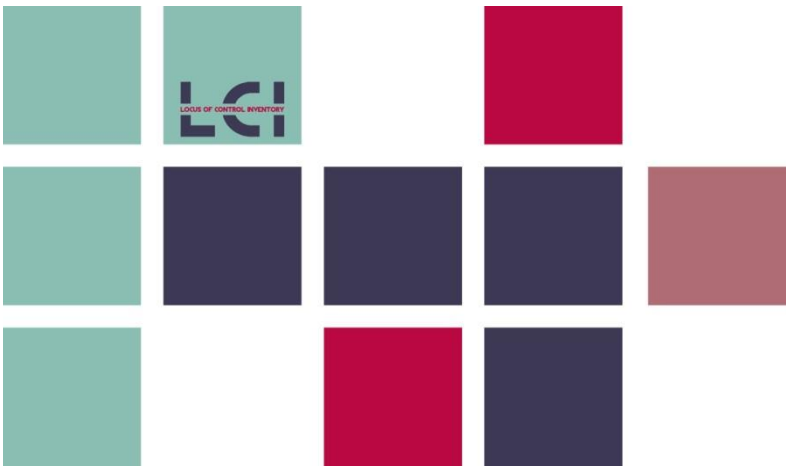
The following R (R Core Team, 2015) packages were used in the analysis:

Psych (Revelle, 2015), lessR (Gerbing, 2015), beanplot (Kampstra, 2008), outliers (Komsta, 2011), mvoutlier (Filzmoser & Gschwandtner, 2015), MVN (Korkmaz, Goksuluk, & Zararsiz, 2015), cocron (Diedenhofen, 2013), Lambda4 (Hunt, 2013), lavaan (Rosseel, 2012), semTools (semTools contributors, 2016), DescTools (Signorell et al., 2016), and Korpus (Michalke, 2016), as well as all associated dependencies.



8. Conclusion

This technical manual details the development of the LCI 5th edition and the psychometric properties of the instrument across two different sample groups. Across both studies the LCI demonstrated acceptable reliability and validity. There is evidence of differential test functioning across ethnicity, which requires further investigation. As a whole, the results support the use of the LCI 5th edition in the South African context.



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