



# A measurement invariance investigation of the differences in shyness between adolescents and adults



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## ABSTRACT

This study addresses the question of whether adolescents or adults are more shy. On the one hand, adolescents spend most of their days functioning as part of a social group (school class), which fosters socialisation processes. However, on the other, in the face of new experiences, shyness may intensify as a result of the development of maladaptive reactions or excessive adjustment to social conventions.

Two studies were conducted on different age samples: 314 adults aged 18–35 and 247 high school students, aged 16. In order to verify the hypotheses, the Revised Cheek and Buss Shyness Scale (RCBS) was administered.

As a result of confirmatory factor analyses, it has been demonstrated that: (1) the structure of shyness among adults and adolescents, as measured by the RCBS scale, could be either interpreted as unifactorial or three-factorial; and (2) there is partial scalar measurement invariance for both the unifactorial and the three-factor models. The comparison of the average latent mean scores suggests that adults are more shy than adolescents, regardless whether the total score or specific factors were compared.

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## 1. Introduction

In general, shyness is defined as discomfort or inhibition (Jones, Briggs, & Smith, 1986). Although shyness can be interpreted in various ways, in the current paper we recognise it as a personality trait and a component of introversion (Hofstee, De Raad, & Goldberg, 1992). One of the most popular research tools for measuring shyness under such a conceptualisation is the Revised Cheek and Buss Shyness scale (RCBS) (Cheek, 1983; Cheek & Buss, 1981). There are a variety of different perspectives on the structure of the RCBS, namely – the unifactorial, two- and the three-factor models (Cheek, 1983; Cheek & Buss, 1981; Crozier, 2005; Hopko, Stowell, Jones, Armento, & Cheek, 2005; Vahedi, 2011). The two-factor model (Crozier, 2005; Vahedi, 2011) comprises factors distinguished only on the basis of item wording (i.e., separate factors for positively and for negatively worded items), whereas the three-factor model (Hopko et al., 2005) distinguishes between facets of shyness – general social distress, stranger shyness and assertiveness difficulty. Among these, a study by Kwiatkowska, Kwiatkowska, and Rogoza (in press) demonstrated that the two-factor model does not yield any psychological meaning: although, in their study, the initial two-factor model was well-fitted to the data and the strength of the factor loadings was high, the introduction of a bifactor into the scale's structure resulted in a radical decrease of the strength of the loadings in specific factors. Thus – only the

unifactorial (Cheek, 1983; Cheek & Buss, 1981) and the three-factor (Hopko et al., 2005) models are promising for the interpretation of the RCBS structure. Until now the structure of RCBS scale has not been verified in an adolescent sample; in particular, so far, no analyses have been carried out in order to resolve the measurement invariance (MI) of the RCBS scale, which is a fundamental prerequisite for conducting comparative analyses between different samples (Van de Schoot, Lugtig, & Hox, 2012).

### 1.1. Age differences in shyness among adults and adolescents

Longitudinal studies provide evidence that shyness in childhood is an important predictor of interpersonal and intrapersonal adjustment difficulties (Grose & Coplan, 2015). Some shy young adults report being shy in early childhood and remaining so until adulthood—therefore, it is considered that, in cases of early-developing shyness, physiological and genetic factors are important in personality development (Cheek & Tyson, 2009). Shy adults reported the first signs of shyness between the age of 8–14, so it is believed that late-developing shyness is a result of problems in social development—particularly at cusp between childhood and adolescence, with the age of 14 considered as a developmental peak for shyness (Cheek & Tyson, 2009).

In the current literature, there is a disagreement regarding age differences in shyness. There are no strict cross-sectional studies investigating differences between the intensity of shyness in adolescent and adult samples and also, neither of the studies on shyness investigated the MI across compared samples, whereas longitudinal studies suggest

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that shyness increases with age (Karevold, Ystrom, Coplan, Sanson, & Mathiesen, 2012; Van Zalk, Lamb, & Rentfrow, 2016). Current paper aims to assess age differences in shyness through cross-sectional comparison of samples and by investigating the MI prior to group comparisons.

## 2. Current study

The goals of the current paper are threefold—we aim to: (1) verify the measurement model of shyness, as measured by the RCBS scale in adults and adolescents; (2) verify whether measurement of shyness is invariant among adults and adolescents; and (3) test the age differences in shyness. Referring to the foregoing research purposes, we hypothesise that:

1. There are two equivalent measurement models of shyness, as measured by the RCBS scale, i.e., the unifactorial and the three-factor, both in adults and adolescents. Our hypothesis is based on previous studies, which demonstrate that the structure of shyness, as measured by the RCBS scale, could be interpreted either as unidimensional or as multidimensional (Cheek, 1983; Cheek & Buss, 1981; Hopko et al., 2005; Kwiatkowska et al., in press).

2. Measurement of shyness (both as the unifactorial and as the three-factor model) is invariant in adults and in adolescents. Although, to date, no study has investigated MI across adolescents and adults, we hypothesise that their results will be invariant, because the meaning and understanding of shyness should be similar in both samples, since it is believed that shyness begins to stabilise after 14 years of age (Cheek & Tyson, 2009).

3. Adults are more shy than adolescents. Despite the fact, that there are no cross-sectional studies demonstrating significant differences between adults and adolescents, longitudinal studies (Karevold et al., 2012; Van Zalk et al., 2016) demonstrate an increase of shyness with age.

## 3. Method

### 3.1. Participants and procedure

#### 3.1.1. Adults research

The study was attended by  $N = 314$  adults (67.5% were women), aged 18–35 ( $M_{\text{age}} = 22.02$ ;  $SD = 2.75$ ). We used the snowball method to recruit participants—a direct link to the survey was shared on the Internet to reach out to a wide and diverse group of recipients.

#### 3.1.2. Adolescents research

The study was attended by  $N = 247$  first-grade high-school students (60.3% were girls), most aged 16 ( $M_{\text{age}} = 15.95$ ;  $SD = 0.22$ ). Research took place during the school hours with the consent of parents, teachers and headmasters.

### 3.2. Measures

In order to verify hypotheses, participants were given the RCBS scale (Cheek & Buss, 1981; polish adaptation: Kwiatkowska et al., in press) to complete. The RCBS scale consists of 13 items and a 5-point response scale. It has been demonstrated to display very good reliability among both adults and adolescents in the measurement of general shyness ( $\alpha_{\text{adults}} = 0.91$ ;  $\alpha_{\text{adolescents}} = 0.85$ ) and moderately acceptable to good in the measurement of shyness facets: General Social Distress ( $\alpha_{\text{adults}} = 0.84$ ;  $\alpha_{\text{adolescents}} = 0.65$ ); Stranger Shyness ( $\alpha_{\text{adults}} = 0.70$ ;  $\alpha_{\text{adolescents}} = 0.53$ ), and Assertiveness Difficulty ( $\alpha_{\text{adults}} = 0.61$ ;  $\alpha_{\text{adolescents}} = 0.49$ ).

### 3.3. Statistical analyses

In order to test Hypothesis 1, we used confirmatory factor analysis (CFA) with robust maximum likelihood estimation to assess the RCBS scale structure among adolescents. Due to the nature of the RCBS scale, which contains four negative formulated test items—we decided to add an additional method factor to the model (Podsakoff, MacKenzie, & Podsakoff, 2012). The method factor is not correlated with any other factor, which constrains the error variance to be equal across selected items, i.e., by introducing the method factor we controlled the measurement error resulting from the negative wording of items. In the assessment of the models we used two approximate indicators of model fit, i.e., Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). The model is considered to be a well-fitted to the data, if: CFI reaches a value  $>0.90$ ; the RMSEA is  $<0.06$  (Hu & Bentler, 1999).

In order to test Hypothesis 2 we assessed four levels of MI across the compared samples: the configural level determines whether CFA is accurate in both samples; the metric level determines whether subjects understand the meaning of latent construct in the same way; the scalar level determines whether the results of the latent variable can be compared with each other in a range of groups; and the strict level, which determines whether the measurement error is equal in compared groups, what enables between-group comparisons using summated scores (Meredith, 1993; Van de Schoot et al., 2012). Full MI can be stated if: (1) the difference between the configural and metric level and the difference between the metric and scalar level in CFI does not exceed 0.005, and (2) any difference between the levels in the range of the RMSEA coefficient should not exceed 0.010 (Chen, 2007). We applied the same criteria to the comparison between scalar and the strict level of invariance.

In order to test Hypothesis 3, after obtaining the MI in a range of samples to assess differences between adults and adolescents, we conducted an assessment of the differences in standardised latent mean scores.

## 4. Results

### 4.1. Verification of the measurement model of the RCBS scale

The model fit indices of the competing unifactorial and three-factor models (with and without the method factor) in adult and adolescent samples are presented in Table 1.

It was revealed that the models without method factor fit the data well in the adult sample, whereas in the adolescent sample the fit indicators fall below assumed criteria. The addition of the method factor improved the fit in both samples and models—it, thus, provides a basis for the conclusion that the structure of shyness, as measured by the RCBS scale, could be analysed using either a unifactorial or three-factor model, in both the adult and the adolescent samples; however, the impact of the negatively worded items is significant, especially within the adolescent sample. The standardised factor loadings of both samples and models, together with the content of test items, descriptive information for analysed samples, and the differences in the mean item level, are presented in an on-line Appendix.

The intercorrelations between shyness facets (both between the summated scores—calculated as the mean of corresponding items—and between the latent variables from the structural model) from the three-factor model are presented in Table 2.

The correlations between the summated scores were moderate in strength in both analysed samples, whereas the correlations between the latent variables were very high.

### 4.2. Measurement invariance of the RCBS scale

The results of MI analyses of the both models are presented in Table 3.

**Table 1**  
Results of the confirmatory factor analyses of the RCBS scale in adult and adolescent sample.

Sample	Model	$\chi^2$ (df)	p	CFI	RMSEA	90% CI	p
Adults	Unifactorial	157.61 <sub>(65)</sub>	0.001	0.940	0.067	0.054–0.081	0.017
	Unifactorial with method factor	138.44 <sub>(64)</sub>	0.001	0.952	0.061	0.047–0.075	0.096
Adolescents	Unifactorial	137.99 <sub>(65)</sub>	0.001	0.883	0.067	0.052–0.083	0.035
	Unifactorial with method factor	92.85 <sub>(64)</sub>	0.011	0.954	0.043	0.021–0.061	0.726
Adults	Three-factor	87.91 <sub>(32)</sub>	0.001	0.948	0.075	0.056–0.093	0.015
	Three-factor with method factor	72.23 <sub>(31)</sub>	0.001	0.962	0.065	0.046–0.085	0.097
Adolescents	Three-factor	88.91 <sub>(32)</sub>	0.004	0.843	0.085	0.064–0.106	0.004
	Three-factor with method factor	50.95 <sub>(31)</sub>	0.013	0.945	0.051	0.023–0.075	0.444

It turned out that adults and adolescents understood the meaning of the latent construct of shyness in the same way, as the metric level of invariance held in both models. However, the latent mean comparisons could not be made, as there was a lack of invariance at the scalar level. Therefore, on the basis of modification indices we decided to free selected item intercepts (items 2, 4, 5 in the unifactorial model; items 2 and 4 only in the three-factor model, as the item 5 was already excluded by Hopko et al., 2005). As a result, the measurement difference between the metric and scalar level, in both samples and models, significantly decreased and turned out to be acceptable. The difference between scalar and the strict model definitely exceeded assumed cut-off criteria, even after freeing parameters from the partial scalar model, which suggests that the measurement error is not equal across compared samples. Therefore, we were able to demonstrate partial scalar MI, and thus the means of latent variables can be compared between samples, whereas due to the lack of the strict invariance – the summated means should not be compared. The results of the latent mean comparisons are shown in Table 4.

Within the studied samples, adolescents obtained significantly lower latent mean scores for shyness than adults, regardless of whether shyness was interpreted as a unifactorial construct or whether its facets were distinguished; thus, our hypothesis was confirmed. For the purpose of additional information, we included the results of a comparison between the summated mean scores of shyness in Table 5, despite the lack of the strict invariance.

All of the differences were significant and in all of them adults turned out to be more shy than adolescents. Thus, these results are in concordance with the latent mean comparisons, which also support our hypothesis.

**5. Discussion**

*5.1. The relevance of the dimensionality of the RCBS scale across adults and adolescents for human development*

As expected, it turned out that the structure of shyness, as measured by the RCBS scale, among adults and adolescents could be either interpreted as the unifactorial or the three-factorial. The addition of method factor improved the model fit, particularly among adolescents. On one hand, this is closely associated with cognitive development, because adolescence is a period of formal thinking and improvements in hypothetical-deductive reasoning (Coleman, 1995)—therefore, negative items may be more difficult, since, in order to answer, it is first necessary to mentally recode these items. On the other hand, it may be

**Table 2**  
Intercorrelations between the facets of shyness.

	GSD	SS	AD
General social distress (SD)		0.94(0.97)	0.96(0.96)
Stranger shyness (SS)	0.71(0.58)		0.99(0.97)
Assertiveness difficulty (AD)	0.69(0.55)	0.65(0.50)	

Note. Above the diagonal are the correlations between latent variables and below the diagonal between the summated scores. Correlations in brackets concern to adolescent sample. All of the correlations were significant at  $p < 0.01$ .

associated with emotional development, since adolescents are more impulsive than adults (Pechmann, Levine, Loughlin, & Leslie, 2005) and thus encounter more attention difficulties. Adults, in turn, are better able to deal with such difficulties; hence, the increase in the model fit among adults after the addition of the method factor is much smaller.

Despite the three-factor model promising a more precise assessment of shyness, it also demonstrated some weaknesses – i.e., the reliability estimates, especially among adolescents were weaker than in the full version of the RCBS and the correlations between latent variables were very strong. The reliability estimates reported by Hopko et al. (2005), who studied an adult sample, were close to those reported within the current study; thus it seems that the measurement of shyness facets is less reliable in adolescents. However – as  $\alpha$  is biased by the number of items (Sijtsma, 2009), and the two least reliable scales comprise only three items – these results should be interpreted with caution. Unfortunately, Hopko et al. (2005) did not report the correlation between the latent variables, but only the summated scores, which are close to those obtained in the current study. The investigation of the correlation between latent variables in both samples, which took into account the measurement error, suggested a strong overlap between the shyness facets. However – such strong correlations may in fact be an artificial result of overly restrictive assumptions of the CFA,

**Table 3**  
Measurement invariance (MI) test of the RCBS scale in adult and adolescent sample.

	$\chi^2$ (df)	p	CFI	RMSEA	90% CI	p
<i>MI level for the unifactorial model</i>						
Configural	228.26 <sub>(128)</sub>	0.001	0.953	0.053	0.042–0.064	0.326
Metric	248.70 <sub>(140)</sub>	0.001	0.949	0.053	0.042–0.063	0.332
Scalar	303.96 <sub>(151)</sub>	0.001	0.928	0.060	0.050–0.070	0.046
Partial scalar (2, 4, & 5)	265.970 <sub>(148)</sub>	0.001	0.944	0.053	0.043–0.064	0.289
Strict	762.20 <sub>(177)</sub>	0.001	0.724	0.109	0.101–0.117	0.001
Partial strict (2, 4, & 5)	551.78 <sub>(168)</sub>	0.001	0.819	0.090	0.082–0.099	0.001
Configural vs metric			0.004	0.000		
Metric vs scalar			0.021	0.070		
Metric vs partial scalar (2, 4, & 5)			0.005	0.000		
Scalar vs strict			0.204	0.049		
Partial scalar vs partial strict (2, 4, & 5)			0.125	0.037		
<i>MI level for the three-factor model</i>						
Configural	121.84 <sub>(62)</sub>	0.001	0.957	0.059	0.043–0.074	0.170
Metric	129.43 <sub>(69)</sub>	0.001	0.957	0.056	0.041–0.071	0.246
Scalar	157.87 <sub>(75)</sub>	0.001	0.941	0.063	0.049–0.076	0.062
Partial scalar (2 & 4)	134.85 <sub>(73)</sub>	0.001	0.956	0.055	0.040–0.069	0.274
Strict	470.54 <sub>(95)</sub>	0.001	0.731	0.119	0.108–0.130	0.001
Partial strict (2 & 4)	366.32 <sub>(89)</sub>	0.001	0.801	0.105	0.094–0.117	0.001
Configural vs metric			0.000	0.003		
Metric vs scalar			0.016	0.007		
Metric vs partial scalar (2 & 4)			0.004	0.001		
Scalar vs strict			0.210	0.056		
Partial scalar vs partial strict (2 & 4)			0.155	0.050		

**Table 4**

Results of the latent mean comparisons of total shyness score and shyness facets.

Factor	Z
Total score	−0.68*
General social distress	−0.73*
Stranger shyness	−0.88*
Assertiveness difficulty	−0.45*

Note. Negative result means that adolescents obtained lower scores.

\*  $p < 0.001$ .

according to which no cross-loadings are assumed (Marsh, Morin, Parker, & Kaur, 2014). Thus, to sum up, there are pros and cons associated with the application of either model; readers' should be aware of these, and on this basis chose the model which is most suited to their research needs.

### 5.2. Measurement invariance of the RCBS scale and interpretation of the weak test items

While the scale yielded the same structure across adults and adolescents, we were able to establish only partial measurement equivalence. As a result, we demonstrated that shyness can be treated as a stable construct among adults and adolescents and it is possible to compare latent mean scores for both the unifactorial (Cheek, 1983; Cheek & Buss, 1981) and the three-factor (Hopko et al., 2005) models. Furthermore, our findings demonstrate that the RCBS scale operationalises the construct similarly in both samples. After verifying for the accuracy of the item translation, we distinguished three test items (two in the three-factor model), which had a significant impact on reducing the model data fit. Adolescents' inaccurate understanding of the first two items' content may be caused by the amount of negations or by the specific and not fully comprehensible wording—in future adolescent studies, the content of these items could be simplified. Lack of intercept equality in the 5th item can be explained theoretically, since adolescents do not have major problems in group relationships—they spend most of their days in the classroom and are greatly exposed to peer influence; therefore, school social networks can have a significant impact on the development of all kinds of social behaviour, depending on the particular pupil's position (Faris & Felmlee, 2011).

### 5.3. Getting more shy with age

Measurement invariance enabled us to compare the latent mean values of shyness between the adult and adolescent samples. As a result, we demonstrated that adults are generally more shy than adolescents, regardless whether we compared the total score or specific factors. This is consistent with results from previous longitudinal studies (Karevold et al., 2012; Van Zalk et al., 2016), but is a novelty in cross-sectional studies.

In accordance with a concept, that shyness has three developmental trajectories (low-stable, increasing shy, and decreasing shy; Schmidt et al., 2016), we could hypothesise that the increasing shy trajectory dominates in the Polish population, because adolescents are less shy than young adults. This hypothesis may well arise from cultural backgrounds,

as shyness is significantly associated with collectivistic cultures in contrast to individualistic ones (Aizawa & Whatley, 2006). Therefore, post-communist countries like Poland being on the borderline of collectivism and individualism, could be more shy nations than more individualistic cultures.

### 5.4. Limitations

The current study is not free from limitations. First of all, our results concerning the measurement of shyness as a construct derived from introversion need to be interpreted with caution, because most current studies point to the fact that shyness has a number of specific subtypes; for example, social withdrawal, which simply reflects a lack of need to keep in touch with others, can be distinguished from fearfulness derived from neuroticism, where isolation is a result of social anxiety (e.g., Briggs, 1988; Jones et al., 1986). Therefore, the interpretation of the overall shyness score may be distorted, as these dimensions can influence each other.

Secondly, during the analyses, we demonstrated that latent mean scores can be meaningfully compared, whereas the summated scores should not be compared at all – due to the lack of strict factorial invariance (Meredith, 1993). In the current paper we reported the differences in summated scores between the samples, which generally confirmed what was achieved in latent comparisons. However, in future studies one should be aware that the lack of strict invariance is a serious limitation in the interpretation of such results, making the interpretation of latent comparisons preferable.

Thirdly, the self-reported measurement of shyness in the adolescent sample may be unreliable, due to the impact of the social desirability of presenting oneself in a favourable light – e.g. as someone who is bold or not weak (Van Zalk et al., 2016). Therefore, in the self-reported measurement, adolescents may have purposely misrepresented their real self-image to avoid standing out from the rest of the group.

Finally, we provided evidence that adults are more shy than adolescents; however, such result may be also interpreted in a different manner. We may posit, for example, that these differences are the result of the cross-sectional research plan. The self-knowledge of young adults in comparison to adolescents is more accurate, as their identity formation processes are more stable (Crocetti, Scrignaro, Sica, & Magrin, 2012); thus adults are capable of describing themselves more precisely and of actually acknowledging that they are shy. However, the existing longitudinal studies do support the hypothesis that adults are more shy (Karevold et al., 2012; Van Zalk et al., 2016).

### 5.5. Suggested future directions

Current measurements of shyness are not sufficient, because it cannot be considered that the structure of the shyness construct is fully resolved. The RCBS scale was originally constructed to measure shyness as a unifactorial construct (Cheek, 1983; Cheek & Buss, 1981), but in further studies the existence of multiple shyness facets was demonstrated (Hopko et al., 2005). Although different types of shyness should be distinguished, the distinction of factors in the RCBS scale is imperfect because the factors are strongly correlated – therefore, a thorough examination of shyness facets is difficult.

**Table 5**

Results of a comparison between the summated mean scores of shyness.

Item/scale	M	SD	S	K	$t_{(559)}$	p
Total score	3.14(2.73)	0.83(0.061)	−0.12(−0.05)	−0.54(0.40)	6.46	0.001
General social distress	3.20(2.65)	0.95(0.67)	−0.23(−0.05)	−0.71(0.32)	7.66	0.001
Stranger shyness	3.15(2.79)	0.93(0.74)	−0.03(−0.12)	−0.50(−0.24)	4.94	0.001
Assertiveness difficulty	2.92(2.71)	0.91(0.77)	0.10(0.06)	−0.49(−0.04)	2.88	0.001

Note. Data for adolescents are separated by brackets, respectively.

A suggestive indicator for the investigation of shyness and its different facets comes from studies on its relationship with basic personality traits. The key personality traits related with shyness are introversion and neuroticism (Briggs, 1988; Cheek & Briggs, 1990; Jones et al., 1986). As a result, shyness can be understood as having two faces – one more introverted, characterised by lower sociability and limited need for contact with other people; and the other more neurotic, closely related to a sense of inferiority, fearfulness and social anxiety manifesting itself in a wide range of somatic symptoms (Briggs, 1988; Cheek & Briggs, 1990; Zimbardo, 1977).

Moreover, shyness may be also associated with another basic personality trait, or third face, agreeableness; it may take a form similar to modesty, defined as moderate self-view – the perception of one's own personality features, skills, physical appearance, or social behaviour as average (Sedikides, Gregg, & Hart, 2007). In previous empirical studies, agreeableness was not linked to shyness, but lexical research, in which synonymous expressions to modesty were analysed, showed that shyness is very closely associated with modesty (Gregg, Hart, Sedikides, & Kumashiro, 2008).

Results presented within the current paper are also consistent with the increasingly popular view that personality (and therefore also shyness) is influenced by various sociodemographic variables, social roles and important events, which affect stability and lead to changes in personality (Van Zalk et al., 2016). The personality structure begins to stabilise during adulthood (Costa & McCrae, 2006); therefore, in the preceding periods it usually deviates from its final shape and structure. Studies have shown that with age extraversion and neuroticism decline, whereas agreeableness increases (Costa & McCrae, 2006; Soto, John, Gosling, & Potter, 2011), which may have a significant effect on different facets of shyness, because shyness motivated by anxiety should decrease, while shyness motivated by social withdrawal and modesty should increase.

Shyness is a specific construct – it takes a characteristic configuration of basic personality traits, but at the same time it is a distinct phenomenon that can take on three different faces: the first related to lower sociability, the second to fearfulness and lower self-esteem, and the third to being modest and not prone to bragging. Hence, we suggest that there is a need to verify shyness types according to the traits of neuroticism, introversion, and agreeableness.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.paid.2017.05.012>.

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