Tutorial: Modelling Acquiescent Response Style in Confirmatory Factor Analysis (CFA) on data from the Czech Republic[1]

Author: Mgr. Johana Chylíková, Ph.D.[2], Czech Social Science Data Archive (CSDA), Institute of Sociology of the Czech Academy of Sciences

Please, do not cite this tutorial when making reference to findings presented here. Instead, cite the article Chylíková, J. (2020). (Un) expected exception: validating acquiescent response style factor in the Czech Republic. International Journal of Social Research Methodology, 1-18.

Summary:

- This tutorial presents the analytical method to identify the acquiescent response style (ARS) and illustrates its application on Czech data.
- Acquiescent response style (ARS) is the tendency of respondents to agree with questions and statements presented to them.
- The method used is called the CF-RS model and it is the model proposed by Billiet and McClendon (2000). It is modelled in the confirmatory factor analysis (CFA) environment and can be applied on data from balanced batteries, i.e., a battery that measures one construct and contains roughly the same number of items formulated in a positive direction towards the measured construct as it does those formulated in the negative direction.
- The CF-RS model contains two latent variables, first that corresponds to the construct measured by the balanced battery, i.e., the content factor (CF), and a latent variable that corresponds to the RS, i.e., the RS factor.
- The RS factor in the CFA model must be validated by its relationship to education and age, i.e., proxy-indicators of cognitive ability.
- The study presented in this tutorial explores the acquiescent response style (ARS) among respondents in the Czech Republic. Large amount of data is used as almost all available balanced batteries of items were analysed.
- Results show that in most of the analysed data, the ARS was not present, as the identified RS factor did not correlate with proxy indicators of cognitive ability.
- The systematic error variance, i.e. the RS factor identified in the Czech data may correspond to some other response style or error of respondent. It is most likely the careless responding, manifested by automatically choosing the extreme agreement, or choosing the first presented answer as a result of memory effect.

[1] The work on this tutorial was funded by CSDA Research - Research program of the Czech Social Science Data Archive: The Czech Republic in the International Social Survey Programme, research on data quality and data resources. Reg. no. CZ.02.1.01/0.0/0.0/16_013/0001796

[2] Send correspondence to johana.chylikova@soc.cas.cz, Jilská 1, Prague 1, 110 00, Czech Republic

Introduction:

Response style (RS) is a tendency in a respondent's behaviour that is not explainable in terms of the question content (Yang, Harkness, Chin & Villar, 2010; Van Vaerenbergh & Thomas, 2013). It is a habitual manner of responding that does not completely reflect what the questionnaire item asks. There are several types of RS; however, this tutorial focuses on the acquiescent response style (ARS), which is the tendency of respondents to agree with questions and statements presented to them. RSs including the ARS represent respondents' reactions to the response scale, such as a Likert scale, on which they express their level of agreement with the question item (McClendon, 1991; Billiet & McClendon, 2000; Groves, 2004; Tourangeau, Rips & Rasinski, 2000).

The ARS has been documented many times in data from various countries worldwide (e.g. Billiet, Cambré & Welkenhuysen-Gybels, 2002; Meisenberg & Williams-Shillingford, 2008; Yang, Harkness, Chin & Villar, 2010; Billiet & McClendon, 2000; Mirowski & Ross, 1991; Ross & Mirowsky, 1984). It has been reported that it results in a systematic RS bias which can undermine the validity of survey data and increase the error of measurement because a certain portion of the variance of the variable reflects a rather systematic error instead of the measured construct. The ARS bias systematically distorts the mean values of the variables and affects the size of the variance of the measured variables (Mirowsky & Ross, 1991; Van Vaerenbergh & Thomas, 2013; Welkenhuysen-Gybels, Billiet & Cambré, 2003).

In data obtained from West European and North American countries, the respondents' tendency to acquiesce was found to correlate with age and education (Weijters, Geuens & Schillewaert, 2010a; Knowles & Condon, 1999; Krosnick, 1991).Empirical data has indicated that the two mentioned proxy indicators of cognitive ability are related to acquiescent response style as older people and people with lower education levels are more likely to acquiesce in surveys (Weijters, Geuens & Schillewaert 2010b; Meisenberg & Williams-Shillingford, 2008; Billiet & McClendon, 2000; Mirowski & Ross 1991; Knowles & Condon, 1999; Krosnick, 1991; Greenleaf, 1992; Ross & Mirowsky, 1984; Watson, 1992; Yang, Harkness, Chin & Villar 2010; Winkler & al., 1982; Narayan & Krosnick, 1996; Warnecke & al., 1997; Knauper, 1999).

Method:

The method presented in this tutorial was proposed by Billiet and McClendon (2000), Mirowsky and Ross (1991) and Watson (1992), who established the criteria for identifying the ARS based on a confirmatory factor analysis (CFA) model. In this tutorial, we call this method the Content Factor-Response Style model (hereafter CF-RS model). The RS factor in the CF-RS model is validated by its relationship with education and age, i.e., proxies of cognitive ability. The necessary precondition of the CF-RS model is that the data must come from a balanced battery of items, i.e., a battery that measures one construct and contains roughly the same number of items formulated in a positive direction towards the measured construct as it does those formulated in the negative direction (see Table 1). The underlying principle of this method assumes that simultaneous agreement with items formulated in favour of the measured construct and items formulated against it indicates the ARS. This method thus does not allow for the possibility that a respondent genuinely holds contradictory views.

Table 1. Example of a balanced battery; source: Our Society surveys conducted by the Public Opinion Research Centre (Centrum pro výzkum veřejného mínění; CVVM):

Wording of items	

Foreign nationals residing in the Czech Republic:	Response scale:
1. enrich our culture 2. increase overall unemployment 3. are the cause of increased criminality 4. help to solve the problem of an ageing population 5. represent a health risk (the spread of disease) 6. contribute to the development of the economy 7. are a threat to our way of life	8. Definitely agree, 9. rather agree, 10. neither agree nor disagree, 11. rather disagree, 12. definitely disagree

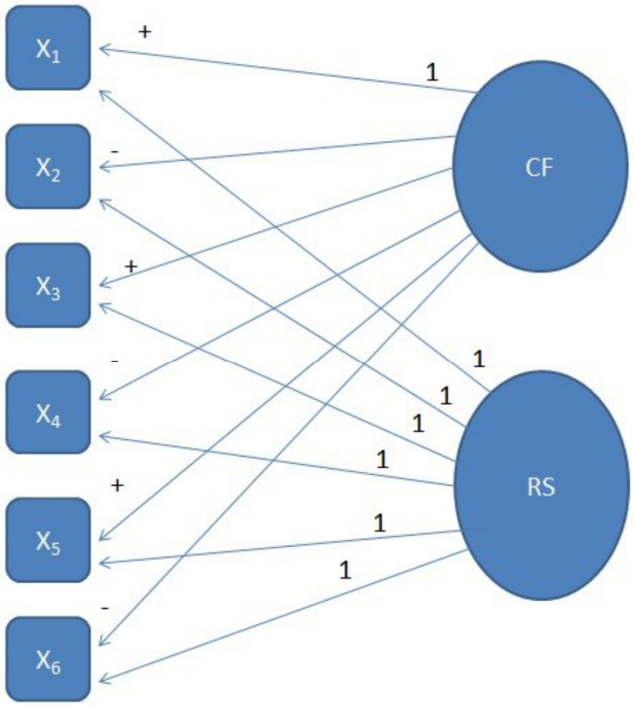
The CF-RS model contains a latent variable that corresponds to the construct measured by the balanced battery, i.e., the content factor (CF), and a latent variable that corresponds to the RS, i.e., the RS factor. The variance of measured variables is thus separated into (1) variance that corresponds to the CF, (2) variance that corresponds to the RS factor, and (3) random error variance, i.e., the remaining variance, which does not correspond to either the construct or the RS (Billiet & McClendon, 2000; Welkenhuysen-Gybels, Billiet & Cambré, 2003; Billiet & Davidov, 2008; Watson, 1992). This partitioning of the variance is expressed in Eq. 1.

$$y = \Lambda_{y1} \xi_1 + \Lambda_{y2} \xi_2 + \varepsilon_y, \quad (1)$$

where *y* represents the measured variable, Λ_y represents the factor loading between the measured variable and the latent variables, ξ_1 and ξ_2 are the latent variables of the measured construct and RS, and ε_y represents the random error.

The specification of the CF-RS model is indicated in the Figure 1 and it follows the specification by Billiet and McClendon (2000). Both latent variables, the CF and the RS factor, influence all the items in the battery. The loadings from the CF are left without constraints, except for the loading of the first item which is standardly set to a value of 1. All the loadings from RS factor are set to a value of 1, because it is assumed that all the items are equally susceptible to ARS. Welkenhuysen-Gybels, Billiet and Cambré (2003) noted that leaving loadings without constraints substantially decreases the trustworthiness of the model. Restricting loadings also saves degrees of freedom necessary to identify the model. The correlation between factors in the CF-RS model is set to 0.

Figure 1: The CF-RS Model – a hypothetical example with six items from a balanced scale.

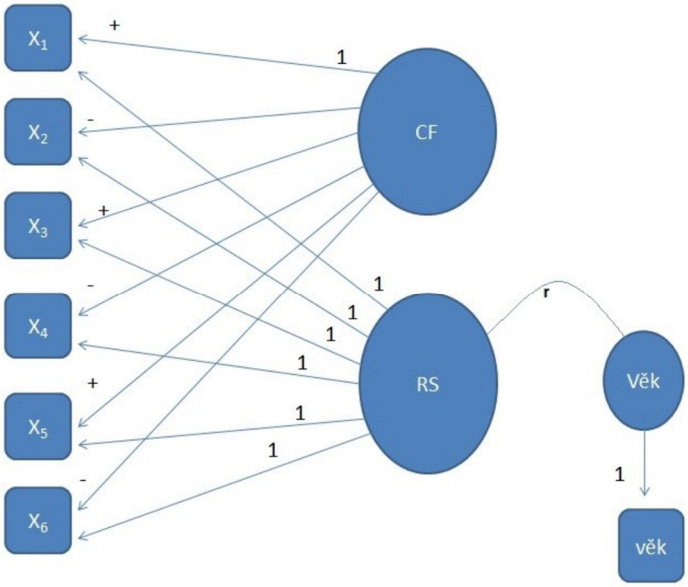


Billiet and McClendon (2000) present validation criteria upon which it can be concluded whether the modelled RS factor is a variance corresponding to the ARS. These criteria are listed below:

(1) Adding the RS factor to the model with the CF will improve the model's fit. In other words, the CF-RS model has a better fit than the corresponding CF model. This criterion stems from the assumption that the division of the common variance of measured variables into two parts – variance of the construct and variance of the systematic method bias – represents a better description of the data.
(2) The RS factor has non-zero variance that is smaller than the variance of the CF.
(3) When the sumagree index is added to the CF-RS model,[3] the model estimates a strong positive correlation between this index and the RS factor.
(4) Following the theoretical precondition about relationship between the ARS and proxies of cognitive ability, Billiet and McClendon demand a positive correlation between age and the RS factor in the CF-RS model, and a negative correlation between education and the RS factor (see Figure 2).
(5) Billiet, Cambré and Welkenhuysen-Gybels (2002) require that standardised factor loadings between items and the RS factor must be smaller than the standardised factor loadings between the items and the CF. This criterion is based on the justified assumption that the RS factor has a much weaker influence on the measured items than the substantive construct that the battery measures.

[3] The sum of a respondent's agreeing responses to all the items in the battery, resp. the items that were entered into the model.

Figure 2: the CF-RS model with age as the latent variable.[4]



Application:

In the analysis, almost all available balanced batteries that were measured in cross-sectional surveys fielded in the Czech Republic since 1993 were employed. These batteries measured one construct and contained at least four items. The data were obtained from surveys conducted in the Czech Republic – namely, the European Values Study (EVS), the International Social Survey Programme (ISSP) and the Our Society (OS) surveys that are fielded by the Public Opinion Research Centre. All surveys were collected by face-to-face interviews. Analyses were carried out in R software (R Studio Team, 2015) in the lavaan package (Rosseel, 2012). The Satorra-Bentler Maximum Likelihood method was used to estimate the parameters of the CFA models.

The analysis was conducted accordingly to the procedure described in the section Method (see the syntax for CR-RS model in Appendix 1). Details of the analysis are to be found in the scholarly article by Chylíková (2020). Twenty different balanced batteries and 52 measurements of these batteries were analysed. The CF-RS properly converged on 5 of these batteries and 20 measurements. The five batteries measured attitudes to marriage, attitudes to immigration (two separate batteries), political efficacy, and attitudes to the death penalty.

The converged models were evaluated from the perspective of the criteria described above. The variance corresponding to the systematic measurement error was identified in almost all CF-RS models. Other criteria were also met with exception of the required correlation between the age and education. This correlation was only observed in the battery that measured political efficacy.

Results indicate that the presence of variance corresponding to the RS can be identified in Czech data when using the CF-RS model. This is the important finding confirming that systematic variance unrelated to the measured construct does exist. However, the analyses showed little evidence of the expected relationship between the RS and proxies of cognitive ability, i.e. age and

[4] The CF-RS model with education as a latent variable and the sumagree index as a latent variable is specified accordingly.

education. In other words, we failed to confirm the important validation criteria upon which the RS factor can be identified as the acquiescent response style.

The only consistent confirmation of the correlation between the RS and proxies of cognitive ability was found in the Political Efficacy battery. We can conclude that the Political Efficacy battery is the closest to a confirmed observation of ARS in Czech data. The most likely explanation of this finding would be that politics is a less salient and more distant issue to respondents and leads (some of) them to exhibit agreeing response style.

The lack of correlation between the RS factor and proxies of cognitive ability raises concern about the nature of modelled RS factor. If we cannot validate it with given criteria, we can hardly consider it an ARS. We must then ask ourselves what exactly is the RS variance identified by the CF-RS model? Based in the fact that RS factors across all presented CF-RS models were a reflection of tendency to agreeing responses and that the factors were comprised mostly of extreme agreement, we can conclude that the RS variance identified in the Czech data indicate the careless responding, manifested by automatically choosing the extreme agreement, or choosing the first presented answer as a result of memory effect.

The finding that the CF-RS model applied on Czech data does not identify ARS is important. It suggests that the acquiescent response style was not present in most of the analysed Czech data and that the identified systematic variance reflects some other error. It also shows us that the CF-RS model cannot be blindly used on all survey data as a method for isolation of ARS.

References

Billiet, J. & McClendon, M. J. (2000). Modeling acquiescence in measurement models for two balanced sets of items. *Structural Equation Modeling* 7(4), 608–628. doi: http://dx.doi.org/10.1207/S15328007SEM0704_5

Billiet, J., Cambré, B. & Welkenhuysen-Gybels, J. (2002). Equivalence of measurement instruments for attitude variables in comparative surveys, taking method effects into account: the case of ethnocentrism. In Ferligoj, A. & Mrvar, A. (Eds), *Developments in Social Science Methodology*, 18, Ljubljana.

Billiet, J. & Davidov, E. (2008). Testing the stability of an acquiescence style factor behind two interrelated substantive variables in a panel design. *Sociological Methods & Research,* 36(4), 542–562. doi: http://dx.doi.org/10.1177/0049124107313901

Groves, R. M. (2004). Survey errors and survey costs. John Wiley & Sons. doi: http://dx.doi.org/10.1002/0471725277

Greenleaf, E. A. (1992). Improving rating scale measures by detecting and correcting bias components in some response styles. *Journal of Marketing Research,* 29(2), 176–188. doi: http://dx.doi.org/10.2307/3172568

Knauper, B. (1999). The impact of age and education on response order effects in attitude measurement. *Public Opinion Quarterly,* 63(3), 347–370. doi: http://dx.doi.org/10.1086/297724

Knowles, E. S. & Condon, C. A. (1999). Why people say 'yes': a dual-process theory of acquiescence. *Journal of Personality and Social Psychology,* 77(2), 379–386. doi: http://dx.doi.org/10.1037/0022-3514.77.2.379

Krosnick, J. A. (1991). Response strategies for coping with the cognitive demands of attitude measures in surveys. *Applied Cognitive Psychology,* 5(3), 213–236. doi: http://dx.doi.org/10.1002/acp.2350050305

McClendon, M. J. (1991). Acquiescence and recency response-order effects in interview surveys. *Sociological Methods and Research,* 20(1), 60–103. doi: http://dx.doi.org/10.1177/0049124191020001003

Mirowsky, J. & Ross, C.E. (1991). Eliminating defense and agreement bias from measures of the sense of control: a 2 x 2 index. *Social Psychology Quarterly,* 54(2), 127–145. doi: http://dx.doi.org/10.2307/2786931

Meisenberg, G. & Williams Shillingford, A. (2008). Are acquiescent and extreme response styles related to low intelligence and education? *Personality and Individual Differences,* 44(7), 1539–1550. doi: http://dx.doi.org/10.1016/j.paid.2008.01.010

Narayan, S. & Krosnick, J.A. (1996). Education moderates some response effects in attitude measurement. *Public Opinion Quarterly,* 60(1), 58–88. doi: http://dx.doi.org/10.1086/297739

Rosseel, Y. (2012). Lavaan: an R package for structural equation modeling. *Journal of Statistical Software,* 48(2), 1–36.

Ross, C. & Mirowsky, J. (1984). Socially-desirable response and acquiescence in a crosscultural survey of mental health. *Journal of Health and Social Behavior,* 25(2), 189–197.

RStudio Team (2015). *RStudio: integrated development for R.* Boston, MA: RStudio Inc. Retrieved from http://www.rstudio.com/

Tourangeau, R., Rips, L. J. & Rasinski, K. (2000). *The psychology of survey response.* Cambridge University Press. doi: http://dx.doi.org/10.1017/CBO9780511819322

Van Vaerenbergh, Y. Thomas, T. D. (2013). Response styles in survey research: a literature review of antecedents, consequences, and remedies. *International Journal of Public Opinion Research,* 25(3), 195–217. doi: http://dx.doi.org/10.1093/ijpor/eds021

Warnecke, R. B., Johnson, T. P., Chávez, N., Sudman, S., O'Rourke, D. P., Lacey, L. & Horm, J. (1997). Improving question wording in surveys of culturally diverse populations. *Annals of Epidemiology,* 7(5), 334–342. doi: http://dx.doi.org/10.1016/S1047-2797(97)00030-6

Watson, D. (1992). Correcting for acquiescent response bias in the absence of a balanced scale: an application to class consciousness. *Sociological Methods & Research,* 21(5), 2–88. doi: http://dx.doi.org/10.1177/0049124192021001003

Weijters, B., Geuens, M. & Schillewaert, N. (2010a). The individual consistency of acquiescence and extreme response style in self-report questionnaires. *Applied Psychological Measurement,* 34(2), 105–121. doi: http://dx.doi.org/10.1177/0146621609338593

Weijters, B., Geuens, M. & Schillewaert, N. (2010b). The stability of individual response styles. Psychological Methods, 15(1), 96–110. doi: http://dx.doi.org/10.1037/a0018721

Weijters, B., Baumgartner, H. & Schillewaert, N. (2013). Reversed Item Bias: An Integrative Model. *Psychological Methods,* 18(3), 320–334. doi: http://dx.doi.org/10.1037/a0032121

Welkenhuysen-Gybels, J., Billiet, J. & Cambré, B. (2003). Adjustment for acquiescence in the assessment of the construct equivalence of Likert-type score items. *Journal of Cross-cultural Psychology,* 34(6), 702–722. doi: http://dx.doi.org/10.1177/0022022103257070

Winkler, J. D., Kanouse, D. E. & Ware, J. E. (1982). Controlling for acquiescence response set in scale development. *Journal of Applied Psychology,* 67(5), 555–561. doi: http://dx.doi.org/10.1037/0021-9010.67.5.555

Yang, Y., Harkness, J. A., Chin, T. Y., Villar, A. (2010). Response styles and culture. In Harkness, J. A., Braun, M., Edwards, B., Johnson, T. P., Lyberg, L., Mohler, P. P., Pennell, B.-E. & Smith (Eds), *Survey Methods in Multinational, Multiregional, and Multicultural Contexts.* doi: http://dx.doi.org/10.1002/9780470609927.ch12

Appendix: The syntax for the CF-RS model with and without correlates, Lavaan package, R statistics:

```
Political_Efficacy_OS2017<-
'CF =~ item1 + item2 + item3 + item4 + item5 + item6 + item7 + item8 + item9
RS =~ item1 + 1*item2 + 1*item3 + 1*item4 + 1*item5 + 1*item6 + 1*item7 + 1*item8 + 1*item9
CF ~~ 0*RS'
fit <- cfa (Political_Efficacy_OS2017, data=OS2017, estimator = "MLM")
summary (fit, fit.measures=TRUE, standardized=TRUE)

Political_Efficacy_OS2017_age<-
'CF =~ item1 + item2 + item3 + item4 + item5 + item6 + item7 + item8 + item9
RS =~ item1 + 1*item2 + 1*item3 + 1*item4 + 1*item5 + 1*item6 + 1*item7 + 1*item8 + 1*item9
CF ~~ 0*RS
AGE =~ age_years'
fit <- cfa (Political_Efficacy_OS2017_age, data=OS2017, estimator = "MLM")
summary (fit, fit.measures=TRUE, standardized=TRUE)

Political_Efficacy_OS2017_education<-
'CF =~ item1 + item2 + item3 + item4 + item5 + item6 + item7 + item8 + item9
RS =~ item1 + 1*item2 + 1*item3 + 1*item4 + 1*item5 + 1*item6 + 1*item7 + 1*item8 + 1*item9
CF ~~ 0*RS
EDUCATION =~ education_categories'
fit <- cfa (Political_Efficacy_OS2017_education, data=OS2017, estimator = "MLM")
summary (fit, fit.measures=TRUE, standardized=TRUE)
```