Religious fundamentalism but not analytical thinking predicts conspiracy bliefs

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Abstract

One or two sentences providing a **basic introduction** to the field, comprehensible to a scientist in any discipline.

Two to three sentences of **more detailed background**, comprehensible to scientists in related disciplines.

One sentence clearly stating the **general problem** being addressed by this particular study.

One sentence summarizing the main result (with the words “**here we show**” or their equivalent).

Two or three sentences explaining what the **main result** reveals in direct comparison to what was thought to be the case previously, or how the main result adds to previous knowledge.

One or two sentences to put the results into a more **general context**.

Two or three sentences to provide a **broader perspective**, readily comprehensible to a scientist in any discipline.

*Keywords:* keywords

*Word count:* X

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# Introduction

It is possible that religious fundamentalism is mediator of the relationships between intelligence and conspiracy beliefs in religious individuals. To test this, we conducted mediation analysis in Structural Equation Modelling (SEM) framework.

# Methods

# Measures

## MDFI

Cronbach’s alpha and McDonald’s omega in current study was satisfactory: = 0.80, 95% CI [0.77 - 0.83], = 0.79, 95% CI [0.76 - 0.82].

## CONSP

The score was measured on five-point Likert scale. Each theory was answered from “Do not correspond at all” (0), “Somewhat do not correspond” (1), “I don’t know” (2), to “Somewhat correspond” (3), and “Completely correspond” (4). For the purpose of further analysis Likert scale was dichotomized such that respondents who answered 0 and 1 were classified as **prone to believe in conspiracy theories** they respond on, and those who answered 2, 3, 4 were classified as **not prone to believe in conspiracy theories**. For each theory respondents believe in, they scored 1 point, which means the summary score ranges from 0 to 20.

Cronbach’s alpha and McDonald’s omega in current study was satisfactory: = 0.96, 95% CI [0.96 - 0.97], = 0.97, 95% CI [0.96 - 0.97].

## RSPM

Cronbach’s alpha and McDonald’s omega in current study was satisfactory: = 0.87, 95% CI [0.85 - 0.89], = 0.87, 95% CI [0.86 - 0.89].

## CRT

Cronbach’s alpha and McDonald’s omega in current study was satisfactory: = 0.90, 95% CI [0.88 - 0.92], = 0.90, 95% CI [0.89 - 0.92].

## Participants

After data collection, we initially collected data from 1662 respondents. However, there was need to remove low quality respondents (*n* = 166). This resulted in 1496 subjects. In the further step, we performed outlier screening using Median Absolute Deviation. The aim of this screening was to identify participants, who answered questionnaires items in the uniform way. In total we identified 5 outliers. However, non of these respondents seem to answer items across questionnaires in the same way. Thus, all of these respondents were kept in dataset. For the purposes of the SEM, we removed participants based on following criteria: first, they were non-religious participants (*n* = 1033), and thus did not filled the MDFI items. Second, we removed respondents, who tried to find right answer to the CRT items on internet during questionnaire filling (*n* = 13). Third, due to an influence of the practice effect, subjects who were already familiar with all CRT questions were also removed. (*n* = 12). Thus, final sample consist of 438 participants (Age: *M* = 50.67, *SD* = 15.79, Females: 44.05%).

## Statistical analysis

Missing data analysis using Little MCAR test suggested that values are missing completely on random. For this reason, incomplete records (RSPM = 8.45%, MDFI = 2.51%) were removed list-wise. Multivariate test of skewness and kurtosis indicated that normality assumption can be rejected. Thus, non-parametric methods were used during statistical analysis. The Breusch–Pagan test indicated that homogeneity of variances is met in our data ( = 0.33, df = 1, p = 0.564. Variance Inflation Factor values (1.58) indicated no multicolinearity in our data. To compare socio-demographic groups in analytical thinking, general intelligence and religious fundamentalism, we used non-parametric version of analysis of variance (Kruskal–Wallis test) which was followed by non-parametric post-hoc tests i.e. Games-Howell and Dunn test. Structural Equation Modelling (SEM) was used to explore relationships between variables of interest. To fit models consisting of categorical variables, we used Diagonally Weighted Least Square estimator (DWLS) on polychoric correlation matrix. In all SEM models, age, gender and education were statistically controlled. In line with practice used in previous studies ([Sinayev & Peters, 2015](#ref-sinayev2015)), RSPM was added into the SEM model first. In the next two steps, MDFI and CRT were added. To evaluate model fit, we used Comparative Fit Index (CFI), Tucker-Lewis index (TLI), mean square error of approximation (RMSEA) and standardized root mean squared residual (SRMR). Values of the CFI and TFI > 0.95 and SRMR < 0.08 and RMSEA <0.06 indicates a good model fit ([Hu & Bentler, 1999](#ref-Hu_Bentler_1999)).

# Results

## Socio-demographic results

Comparison between socio-demographic groups suggested significant differences in general intelligence, analytical thinking and religious fundamentalism between these groups. Results of this comparison are reported in the table 1.

Table 1:

*Socio-demographic comparisson and group differences*

| key | value | n | percent | CONSP Group difference | CRT Group difference | RSPM Group difference | MDFI Group difference | MDFI | CRT | RSPM | CONSP |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Gender | 1 Male | 218.00 | 49.77 | 1 vs 2, W = 19751, p = 0.001 | 1 vs 2, W = 22065, p < .001 | 1 vs 2, W = 22688, p = 0.025 | NA | (2.65;0.55) | (2.55;1.47) | (5.34;2.31) | (8.12;5.55) |
|  | 2 Female | 220.00 | 50.23 |  |  |  |  | (2.68;0.48) | (2.03;1.47) | (4.8;2.44) | (10.01;6.12) |
| Religiosity | 1 Yes, I am a member or church/rel.society | 126.00 | 28.77 | NA | NA | NA | 1 vs 2, W = 25580.5, p < .001 | (2.93;0.52) | (2.33;1.56) | (4.94;2.53) | (8.29;5.96) |
|  | 2 Yes, but I am not a member of church/rel.society | 312.00 | 71.23 |  |  |  |  | (2.56;0.47) | (2.29;1.46) | (5.12;2.33) | (9.39;5.87) |
| Economical\_status | 1 Pensioner | 167.00 | 38.13 | 2 vs 4, z = -3.86, p = 0.001, 2 vs 5, z = -3.08, p = 0.021 | 1 vs 4, z = 3.07, p = 0.022, 1 vs 5, z = 3.35, p = 0.008, 2 vs 4, z = 3.71, p = 0.002, 2 vs 5, z = 4.07, p < .001 | 1 vs 4, z = 5.46, p < .001, 1 vs 5, z = 2.83, p = 0.046, 2 vs 4, z = 3.29, p = 0.010 | 1 vs 5, t(40.64) = -0.38, p < .001, 2 vs 5, t(50.5) = -0.4, p < .001, 4 vs 5, t(43.37) = -0.31, p = 0.008 | (2.72;0.49) | (2.01;1.39) | (4.32;2.2) | (9.6;6.01) |
|  | 2 Without work | 39.00 | 8.90 |  |  |  |  | (2.74;0.34) | (1.51;1.25) | (4.32;2.42) | (12.46;6.09) |
|  | 3 Student | 14.00 | 3.20 |  |  |  |  | (2.71;0.64) | (2.77;1.64) | (5.69;2.46) | (7;4.64) |
|  | 4 Employed | 185.00 | 42.24 |  |  |  |  | (2.65;0.55) | (2.55;1.48) | (5.75;2.33) | (8.25;5.67) |
|  | 5 Entrepreneur | 29.00 | 6.62 |  |  |  |  | (2.34;0.42) | (3.12;1.58) | (5.73;2.27) | (7.79;5.59) |
|  | Missing | 4.00 | 0.91 |  |  |  |  | (2.65;0.27) | (1.5;0.71) | (5;2.83) | (8.5;5.2) |
| Education | 1 Basic school | 29.00 | 6.62 | 1 vs 4, t(38.75) = -4.53, p = 0.003, 2 vs 4, t(251.95) = -4.43, p < .001, 3 vs 4, t(241.01) = -2.87, p < .001 | 2 vs 4, t(202.05) = 1.05, p < .001, 3 vs 4, t(215.57) = 0.69, p = 0.004 | 2 vs 4, z = 6.18, p < .001, 3 vs 4, z = 4.08, p < .001 | 2 vs 4, z = -2.81, p = 0.030 | (2.77;0.57) | (2.28;1.43) | (5.07;2.63) | (10.72;5.96) |
|  | 2 Vocational school or non - maturity high school | 165.00 | 37.67 |  |  |  |  | (2.74;0.49) | (1.89;1.31) | (4.36;2.23) | (10.62;5.86) |
|  | 3 Higher vocational school or high school | 138.00 | 31.51 |  |  |  |  | (2.64;0.5) | (2.26;1.62) | (4.95;2.34) | (9.07;5.94) |
|  | 4 University | 106.00 | 24.20 |  |  |  |  | (2.55;0.53) | (2.95;1.36) | (6.28;2.15) | (6.2;4.86) |
| Family\_status | 1 Not in relationship | 57.00 | 13.01 |  |  | 2 vs 5, z = -3.45, p = 0.006, 3 vs 5, z = -3.55, p = 0.004, 4 vs 5, z = -3.01, p = 0.026 |  | (2.76;0.62) | (2.37;1.55) | (5.43;2.42) | (8.65;5.65) |
|  | 2 In relationship | 59.00 | 13.47 |  |  |  |  | (2.62;0.6) | (2.35;1.38) | (5.32;2.43) | (8.81;6.07) |
|  | 3 Married | 215.00 | 49.09 |  |  |  |  | (2.68;0.47) | (2.32;1.54) | (5.15;2.42) | (8.84;5.72) |
|  | 4 Divorced | 74.00 | 16.89 |  |  |  |  | (2.64;0.49) | (2.31;1.43) | (5.05;2.11) | (9.95;6.37) |
|  | 5 Widow/Widower | 33.00 | 7.53 |  |  |  |  | (2.55;0.42) | (1.89;1.37) | (3.43;2.05) | (9.82;6.38) |
|  | 2 Female | 220.00 | 50.23 |  |  |  |  | (2.68;0.48) | (2.03;1.47) | (4.8;2.44) | (10.01;6.12) |
|  | 2 Yes, but I am not a member of church/rel.society | 312.00 | 71.23 |  |  |  |  | (2.56;0.47) | (2.29;1.46) | (5.12;2.33) | (9.39;5.87) |

*Note.* \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001; SD = standard deviation, M = mean, CONSP = Conspiracy beliefs, RSPM = Raven’s Progressive Matrices , CRT = Cognitive Reflection Test, Spearman´s correlations were utilised, t values idicates use of Games-Howell test, Z value indicates use of the Dunn test

## Results of correlation analysis

Correlation analysis revealed that there is a strong positive correlation between analytical thinking and general intelligence. Moreover, both analytical thinking and general intelligence weakly and negatively correlated with age. In addition, there was a weak negative correlation between conspiracy beliefs and both analytical thinking and general intelligence. Finally, there was medium positive association between conspiracy beliefs and religious fundamentalism. For further results of correlation analysis see table 2.

Table 2:

*Correaltion table with means and standard devations*

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | M | SD |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. Age | - |  |  |  |  |  |  |  | 51.45 | 16.05 |
| 2. CONSP | .05 | - |  |  |  |  |  |  | 9.07 | 5.91 |
| 3. RSPM | -.30\*\*\* | -.28\*\*\* | - |  |  |  |  |  | 5.07 | 2.38 |
| 4. CRT | -.12\* | -.22\*\*\* | .57\*\*\* | - |  |  |  |  | 2.30 | 1.49 |
| 5. MDFI | .00 | .35\*\*\* | -.26\*\*\* | -.30\*\*\* | - |  |  |  | 2.66 | 0.51 |
| 6. Gender | .10\* | .15\*\* | -.11\* | -.18\*\*\* | .02 | - |  |  | 1.50 | 0.50 |
| 7. Education | .03 | -.29\*\*\* | .27\*\*\* | .24\*\*\* | -.14\*\* | -.17\*\*\* | - |  | 2.73 | 0.90 |
| 8. Religiosity | -.09 | .09 | .03 | -.01 | -.30\*\*\* | .02 | -.14\*\* | - | 1.71 | 0.45 |
| 9. Family\_status | .53\*\*\* | .06 | -.14\*\* | -.04 | -.04 | .24\*\*\* | .03 | .01 | 2.92 | 1.06 |

*Note.* \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001; SD = standard deviation, M = mean, CONSP = Conspiracy beliefs, RSPM = Raven’s Progressive Matrices , CRT = Cognitive Reflection Test, Spearman´s correlations were utilised

## Mediation analysis

In the first step (model 1), we examined whether cognitive ability will predict conspiracy beliefs. It was revealed that with one unit increase in cognitive ability, a number of conspiracy theories towards which people were hesitate or believed in decreased by -1.41 (table 3). Furthermore, as correlation matrix indicated that there is a positive association between conspiracy belief, religious fundamentalism and cognitive ability, we expected that religious fundamentalism might mediate relationship between cognitive ability and conspiracy beliefs. For this reason, in the next step (model 2), mediation variable i.e. religious fundamentalism was added into the SEM model. Results revealed that adding religious fundamentalism partially mediated the direct effect of analytical thinking on conspiracy beliefs (table 3). In more detail, with every one unit increase in the MDFI score, the number of conspiracy theories in which people believed in or to which they were hesitated to increased by 3.08 (table 3).

Table 3:

*Direct and indirect effects of the three SEM models*

| Direct and mediated effects | Beta | p-value | B (95% CI) |
| --- | --- | --- | --- |
| **Model 1** |  |  |  |
| RSPM - CONSP (direct) | -0.27 | p < .001 | -1.41(-2.06,-0.78) |
| **Model 2** |  |  |  |
| RSPM - CONSP (direct) | -0.18 | p = 0.008 | -6.18(-10.84,-1.74) |
| MDFI - CONSP (direct) | 0.26 | p < .001 | 3.08(2.09,4.15) |
| RSPM - MDPI (direct) | -0.32 | p < .001 | -0.91(-1.44,-0.55) |
| MDPI (indirect) | -0.08 | p < .001 | -2.81(-4.76,-1.5) |
| **Model 3** |  |  |  |
| RSPM - CONSP (direct effect) | -0.23 | p = 0.185 | -0.7(-1.81,0.34) |
| MDFI - CONSP (direct effect) | 0.25 | p < .001 | 2.88(1.78,3.9) |
| CRT - MDFI (direct effect) | -0.36 | p < .001 | -0.09(-0.13,-0.06) |
| RSPM - MDFI - CONSP (indirect effect) | -0.09 | p < .001 | -0.27(-0.47,-0.17) |
| RSPM - CRT - CONSP (indirect effect) | 0.03 | p = 0.874 | 0.26(-2.68,3.74) |

*Note.* RSPM = Ravens Standardized Progresive Matrices, CONSP = Belief in Conspiracy Theories, MDFI = Multi-Dimensional Fundamentalism Inventory, CRT = Cognitive Reflection Test

Correlation matrix also indicated that cognitive ability was strongly correlated with analytical thinking (table 2). Therefore, it was possible that if analytical thinking would be taken into account, cognitive ability would not predict conspiracy theories anymore. For this reason, in the final step (model 3), we added analytical thinking into structural equation model. It was found that cognitive ability as well as analytical thinking no longer predicted conspiracy beliefs. In more detail, no significant association with conspiracy beliefs and analytical thinking was present, when shared variance with the cognitive ability was taken into account (figure 1). Table 5 presents Goodness of fit of individual SEM models. Results suggests that adding new predictors lead to increase in model fit and thus, non of these predictors were added redundantly.

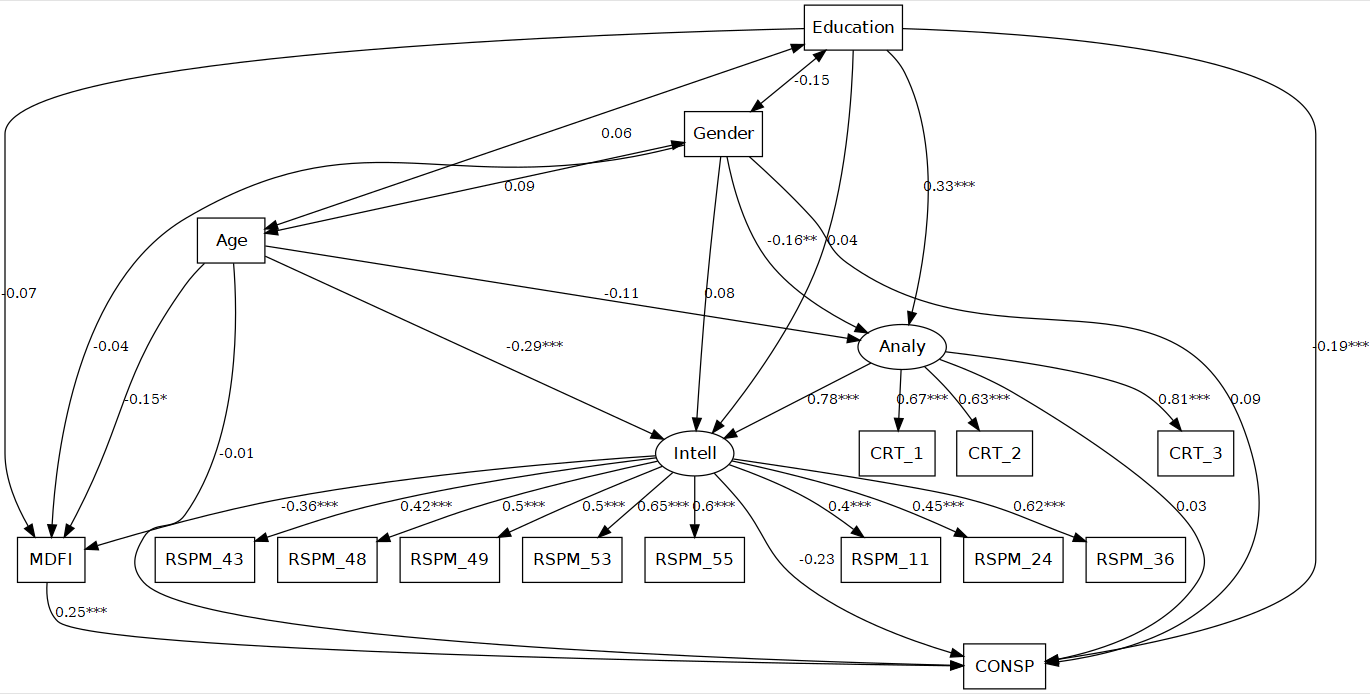


Figure : *The* *SEM* diagram depicting mediating relationship of religious fundamentalism on the link between analytical thinking and conspiracy beliefs; MDFI = MDFI = Multi-Dimensional Fundamentalism Inventory; RSPM = Ravens Standardized Progresive Matrices; Analy = Analytical thinking; CRT = Cognitive Reflection Test; CONSP = Belief in Conspiracy Theories; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001; *n*=438

Table 4:

*Goodness of fit indices values of modles tested in SEM*

| Model | x2 | df | p-value | CFI | TLI | RMSEA | SRMR |
| --- | --- | --- | --- | --- | --- | --- | --- |
| RSPM - COSNP | 52.796 | 48 | 0.294 | 0.996 | 0.995 | 0.016 (0.000-0.037) | 0.04 |
| RSPM - COSNP - MDFI | 55.815 | 55 | 0.444 | 0.999 | 0.999 | 0.006 (0.000-0.032) | 0.038 |
| RSPM - COSNP - MDFI - CRT | 81.114 | 89 | 0.712 | 1 | 1.004 | 0.000 (0.000-0.022) | 0.039 |

*Note.* x2 = chi-square, df = degrees of freedom, CFI = Comparative Fit Index, TLI = Tucker-Lewis index, RMSEA = Root Mean Square Error of Approximation , CI = Confidence Interval, SRMR = Standardized Root Mean Square Residual, SEM = Structural Equation Modelling

# Discussion

Val v diskusi bych zmínil debatu o tom, nakolik CRT skutečně měří intuitivní a myšlení a nakolik numerické schopnosti či obecnou inteligenci. Jinak řečeno, linka by byla následující:

1. víme, že CRT byl vytvořen tak aby měřil intuitivní a analytické myšlení dle duální teorie Kahnemana a Traverskeho - dodat reference
2. současně víme, že zde existují studie, které indikují, že spíše než analytické/intuitivní myšlení, měří CRT ve skutečnosti numerické schopnosti (<https://doi.org/10.3389/fpsyg.2015.00532>) či obecnou inteligenci (<https://cogsci.mindmodeling.org/2013/papers/0296/index.html>) např - dodat další reference
3. pokud je bod 2 pravda, pak by se neměla objevit souvislost mezi CRT a konspiračními teoriemi, když budeme kontrolovat obecnou inteligenci
4. ačkoli sice existují studie (<https://doi.org/10.3389/fpsyg.2015.00532>), které již prokázaly, že decision biasy, dokáží spíše předpovědět numerické schonosti či obecná inteligence než CRT, žádná ze studií neprozkoumala tuto souvislost u konspiračních teorií, které jsou v souvislosti s CRT často zkoumány
5. Abychom tedy přispěli k dikusím o tom, do jaké míry měří CRT dokáže předpovědět konspirační teorie poza to, co má společné s obecnou inteligencí, rozhodli jsme se realizovat tuto studii
6. skutečně jsme zjistili, že CRT had no significant association with conspiracy beliefs, when shared variance with the cognitive ability was taken into account

## Implications for theory

**Implications for research and practice**

# Supplementary material

# References

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