Do empathic abilities mediate the relationship between fiction media exposure and altruism? A structural equation modelling approach

Home exam

Tim R. Blauberger

University of Gothenburg

PS2305: Methods V

Pernilla Larsman, Magnus Lindwall

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Background

Previous research suggests that reading fictional media predicts the empathic abilities of an individual (Mar et al., 2009; Mumper & Gerrig, 2017). Multiple mechanisms of this relationship have been discussed, ranging from fiction simulating social worlds (Oatley, 2016) to an activation of similar networks in the brain (Hsu et al., 2014). In turn, empathic abilities have been suggested to predict altruistic behaviour (Batson et al., 1981). I want to investigate whether *exposure* to fiction media, a construct I will describe in larger detail later on, has a similar relationship with empathic abilities and altruism as *reading* fiction media has.

Research aim. I want to test the hypothesis that fictional media exposure positively predicts altruism, and that this relationship is partially mediated by empathic abilities.

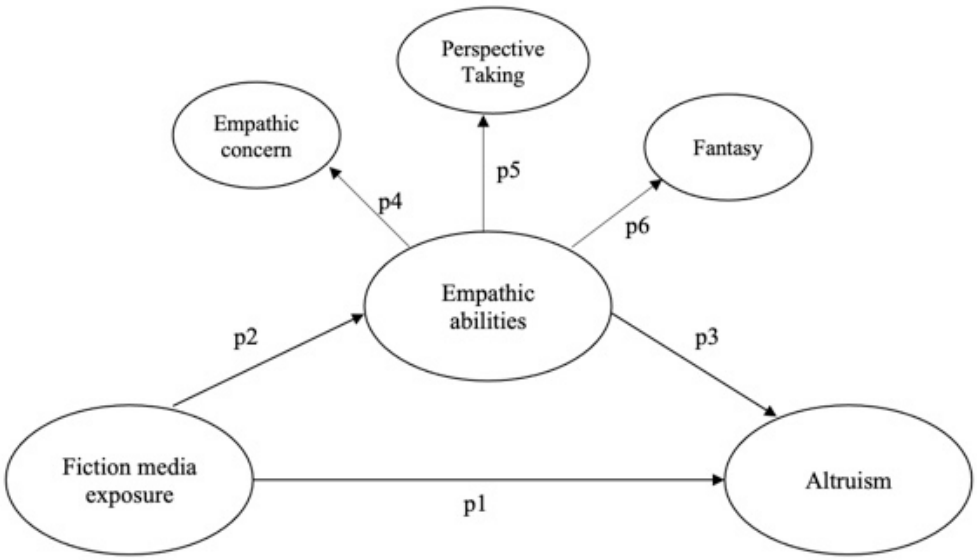
Model specification & Hypotheses

Structural model

The structural model I test in this assignment is presented in figure 1. It consists of the exogenous variable "Fiction media exposure" as well as the endogenous variables "Empathic abilities" and "Altruism". Empathic abilities is a second order factor, being further comprised of three factors, namely "empathic concern", "perspective taking" and "fantasy". I adopted this factor structure of empathic abilities as the used questionnaire was designed to measure these three dimensions.

Figure 1

The structural model tested in this assignment. Measurement models including error terms and indicators as well as disturbance terms of the depicted latent variables are omitted from this figure.



Hypotheses

I hypothesize that fiction media exposure positively predicts altruism (p1) as well as empathic abilities (p2), and that empathic abilities is positively associated with altruism (p3). This results in a model of partial mediation, in which empathic abilities serves as a mediator between fiction media exposure and altruism. This mediation, in which I expect all paths (p1, p2, p3) to be positive relationships, is the core of my structural model and my hypotheses. I further expect the associations between empathic abilities and each of its dimensions (p4, p5, p6) to be positive.

Methods

Study design and participants

The dataset I use was uploaded to osf.io (open science foundation) on the 19.06.2019 by Rose Turner and Fatima Maria Felisberti from the University of the Arts, London (Turner & Felisberti, 2018). The sample initially included 404 participants. I excluded four participants, as they did not answer all items that are used as indicators in this analysis (listwise deletion). The mean age of the remaining n=400 participants is 36.4 years (ranging from 17 to 74 years). Of these participants, 326 (82.1%) identified as female and 71 (17.9%) as male while three participants did not specify their gender.

Measures

Fiction media exposure. A fiction media exposure test was used to measure the exposure to authors, film titles and play titles. Exposure to each of these three media is measured by 30 dichotomous items that represent real names / titles and additionally 25 (authors) or 15 (films / plays) "foil" items with imaginative names / titles to control for social desirability and overclaiming. Participants answer by indicating that they recognize each name (0) or not (1). As indicators in the model, I used composite scores for each medium (literature, film, play) consisting of the number of recognized names / titles minus the amount of falsely recognized foil items.

Empathic abilities. A questionnaire for empathic abilities with three dimensions (empathic concern, perspective taking, fantasy) and 7 items per dimension (1 to 5 Likert-scale) was used. The original IRI scale, from which the questionnaire was adopted, consist of four dimensions. The authors who collected the data decided to omit one of these dimensions (personal distress) from their survey, as it has – in contrast to the other three dimensions – not shown to be related to fiction media reading in previous research (Mumper & Gerrig, 2017).

Altruism. A self-report questionnaire on altruistic behaviour with 9 items (1 to 5 Likert-scale) was used. The questionnaire was adapted from Rushton and colleagues (1981). While the original questionnaire consists of 20 items, the authors who obtained the data selected nine items covering "a range of helpful acts toward acquaintances, strangers, and charity" (Turner & Felisberti, 2018).

Statistical analysis

Preparation of data / Assumptions. To test for the assumption of multivariate normality, I calculated Mardia's coefficient (z=11.9). This value indicates non-normality, even though to a degree that is not necessarily problematic. Next, I analysed univariate normality (skewness, kurtosis) of each indicator. I decided to exclude one indicator of empathic concern (Empathic_concern_5) due to skewness <-2 and kurtosis >4. After that, I calculated Mahalanobi's Distance (MD) for each participant to detect multivariate outliers. I chose MD>62.48 (df =32, p<.001) as the critical value for outlier detection across the 32 remaining indicators. Four participants had an MD greater than 62.48, marking them as multivariate outliers. After these steps, Mardia's coefficient decreased to z=9.03. The remaining model is shown in figure 3 in the appendix.

Model estimation. To calculate the SEM model, I used the statistical software Jamovi version 2.3 (The jamovi project, 2022) with the extension SEMlj (Gallucci & Jentschke, 2021). Measurement models and the structural model were analysed simultaneously. I used maximum likelihood as the method for parameter estimation. All standard errors and confidence intervals are based on bias-corrected bootstrapping (2000 samples). I decided to use maximum likelihood in combination with bootstrapping, as multivariate normality is imperfect and as I intend to test for mediation. Bootstrapping allows to calculate a standard error and thus the statistical significance of the indirect effect (p2*p3). To scale latent variables, the unstandardized regression weight of each latent variable with its first indicator was restricted to 1.

Results

Model identification and fit. The model is overidentified with df = 102. The number of observations is 396. The chi-squared test (X^2=995, df=458, p<.001) is highly significant, indicating a significant difference between the observed and the model-implied covariance matrices. The normed X^2 = 2.17 (X^2 / df) indicates that the model does not show perfect but at least good fit to the data. The RMSEA = 0.058 (95% CI [.053; .063], p=.004) also indicates an acceptable model fit, just as the SRMR = 0.072. The CFI = 0.842 however lies under the recommended value of 0.90, which indicates poor model fit and the need for modifications.

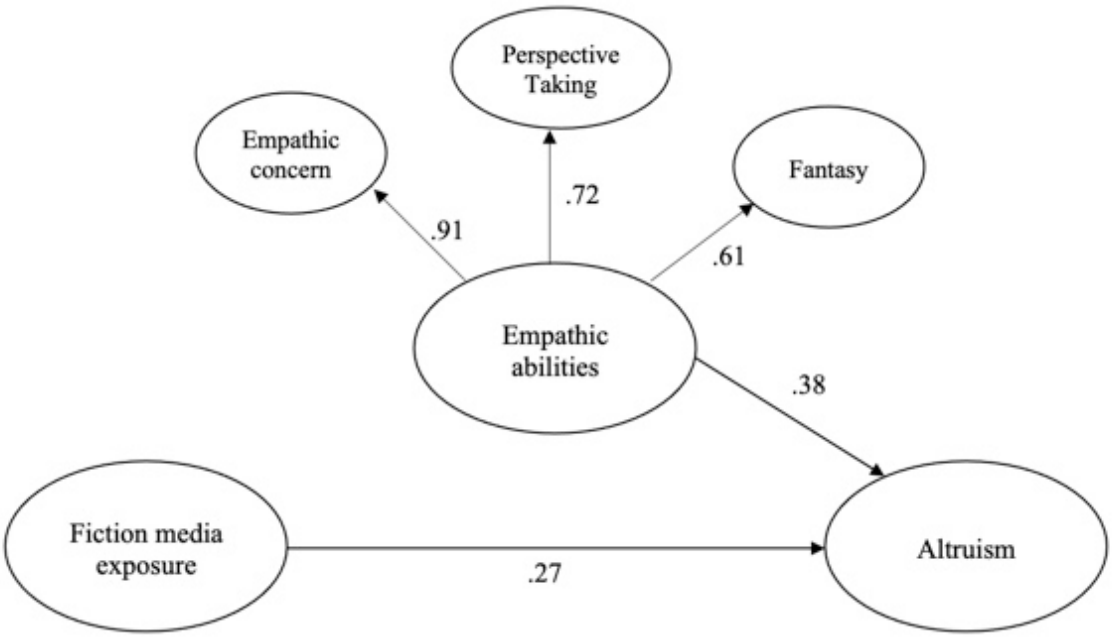
Measurement models. Internal reliability is good across all factors with McDonald's ω >.70 (see table 3 in the appendix for reliability estimate of each factor). The factor loadings and formulations of all items are presented in table 4 in the appendix. All indicators of fiction media exposure have standardized factor loadings of ω >.80. However, seven indicators for altruism show standardized loadings of ω <.50. Also, each of the dimensions of empathic abilities has at least one indicator with factor loadings of ω <.50.

Structural model

The resulting structural relationships of the model are depicted in figure 2. Against my hypothesis, not all paths are positive and statistically significant.

Figure 2

The estimated structural model. Arrows indicate statistically significant relationships (p<.01). The estimates represent standardized regression weights for each path.



The estimates for each path are presented in table 1. The effect of fiction media exposure on empathic abilities (p2) is nearly zero and not statistically significant. All other paths included in the structural model display a positive and statistically significant relationship. The variance in altruism explained by fiction media exposure and empathic abilities is R^2=.221.

Table 1

The resulting estimates of the structural model in my SEM-analysis.

Effect	Estimate	CI 95 %	SE	Standardized	*p*-value
P1	0.0236	0.012; 0.037	0.0063	.274	<.001
P2	0.0023	-0.014; 0.019	0.0083	.018	.78
P3	0.2476	0.139; 0.391	0.0626	.377	<.001
P4	1.000	1.000; 1.000	0.0000	.914	-
P5	0.429	0.297; 0.623	0.0831	.715	<.001
P6	0.601	0.431; 0.820	0.0974	.606	<.001

The results of the mediation analysis are presented in table 2. Clearly, the indirect effect of fiction media exposure on altruism (p2*p3) is close to zero and not statistically significant. The direct effect (p1) is positive and statistically significant, as well as the effect of empathic abilities on altruism (p3). Thus, based on this analysis, empathic abilities is not a mediator between fiction media exposure and altruism.

Table 2

The results of my mediation analysis.

Effect of fiction media exposure on altruism	Estimate	CI 95%	SE	Standardized	*p*-value
Direct effect (p1)	0.024	0.012; 0.037	0.0063	.274	<.001
Indirect effect (p2*p3)	0.001	-0.003; 0.005	0.002	.007	.785

Discussion

My hypothesis that empathic abilities mediate the relationship between fiction media exposure and altruism has not been confirmed. Instead, fiction media exposure and empathic abilities seem to independently predict altruism. However, there are problems in the measurement model as multiple indicators have low factor loadings. The low CFI might mirror this issue and suggests problems in the factor structure of my model. These issues will be further explored in the next section. Whereas the analysis has been confirmatory to this point, I will enter exploratory territory from the next section on, to increase the model's fit to the data – changes that would have to be confirmed using independent data.

Modifications of the model

To improve model fit, I decided to remove seven indicators from the model. Specifically, I removed the indicators Fantasy_2, Altruism_8 and Altruism_9 due to factor loadings <.40. Additionally, I removed the indicators Empathic_abilities_2, Empathic_abilities_4,

Perspective_taking_1 and Perspective_taking_4. These latter four indicators are especially interesting. Not only did they load poorly on their factors, but an exploratory factor analysis suggested that these indicators form a factor on their own. Reading the item formulations, I could not identify a content related reason, that would justify a fourth factor of empathic abilities. But importantly, all four indicators were reversed items. Taken together, at this point of the analysis I have removed six out of the seven reversed items of the IRI due to low factor loadings or severe non-normality. Previous research discussed the so-called "reversed item bias", due to which participants tend to answer reversed items differently (Herche & Engelland, 1996). Weijters and colleagues (2013) point out that "reversed items often lead to problems, particularly poor model fit of factor models" and warn that the originally hypothesized factor structure might seem to be inadequate – even though the error is actually induced by reversed item bias. Even though this does not explain all of my model's problems in terms of fit to data, it offers important insight into the issues of the measurement models. Removing these seven indicators improved the model fit to SRMR = .059, RMSEA = .052 (95% CI [.046; .058], p = .278) and CFI = .914. Thus, all indexes have been improved in comparison to the confirmatory model above. All model fit indexes are now in an acceptable range, while the internal reliability of each factor remains ω >.70 (see table 3 in the appendix). The results regarding my research question remain the same (see tables 5 and 6 in the appendix for the estimates). Clearly, empathic abilities do *not* mediate the relationship between fiction media exposure and altruism. The explained variance in altruism is R^2=.263. I want to mention briefly that I tried out further modifications by removing even more variables from the model. An analysis without the second order factor revealed that fantasy, in contrast to the other dimensions of empathic abilities, had a negative relationship with altruism. Retaining the second order factor but removing fantasy with all its indicators from the model further increased model fit compared to the model described above. However, these changes are even more drastic and go deeper into exploring the underlying constructs, posing questions whose answers would go beyond the scope of this assignment. Most importantly, the results regarding my research question stayed the same throughout all models.

Conclusion

Modifying the model by removing seven indicators, I was able to reach acceptable indexes of model fit. However, these changes are exploratory and not driven by theory but by statistical means. Thus, one might argue which of the models should ultimately be preferred. After all, the most important result remains clear throughout all models: against my hypothesis, the indirect effect of the mediation showed very low effect sizes and was not statistically significant in any of the models. Instead, both models revealed a direct and independent effect of both fiction media exposure and empathic abilities on altruism.

References

Batson, C. D., Duncan, B. D., Ackerman, P., Buckley, T. & Birch, K. (1981). Is empathic emotion a source of altruistic motivation? *Personality and Social Psychology, 40,* 290-302. http://dx.doi.org/10.1037//0022-3514.40.2.290

Gallucci, M., Jentschke, S. (2021). SEMLj: jamovi SEM Analysis. Jamovi module. https://semlj.github.io

Herche, J., Engelland, B. Reversed-polarity items and scale unidimensionality. JAMS 24, 366–374 (1996). https://doi.org/10.1177/0092070396244007

Hsu, C., Conrad, M., & Jacobs, A. M. (2014). Fiction Feelings in Harry Potter: haemodynamic responses in the mid-cingulate cortex correlates with immersive reading experience. Neuroport, 25, 1356-1361. http://dx.doi.org/10.1097/WNR.0000000000000272

Mar, R. A., Oatley, K., & Peterson, J. B. (2009). Exploring the link between reading fiction and empathy: Ruling out individual differences and examining outcomes. Communications, 34, 407-428. http://dx.doi.org/10.1515/COMM.2009.025

Mumper, M. L., & Gerrig, R. J. (2017). Leisure reading and social cognition: A meta-analysis. Psychology of Aesthetics, Creativity and the Arts, 11, 109-120. http://dx.doi.org/10.1037/aca0000089

Oatley, K. (2016). Fiction: Simulation of social worlds. Trends in Cognitive Sciences, 20, 618-628. http://dx.doi.org/10.1016/j.tics.2016.06.002

Rushton, J. P., Chrisjohn, R.D., & Fekken, G. C. (1981). The altruistic personality and the self-report altruism scale. Personality and Individual Differences, 1, 292-302. http://dx.doi.org/10.1016/0191-8869(81)90084-2

The jamovi project (2022). Jamovi. (Version 2.3) Computer software. Retrieved from https://www.jamovi.org.

Turner, R. & Felisberti, F. (2018). Relationships between fiction media, genre, and empathic abilities. Scientific study of literature, 8(2), 261–292. https://doi.org/10.1075/ssol.19003.tur

Weijters, B., Baumgartner, H., & Schillewaert, N. (2013). Reversed item bias: an integrative model. Psychological methods, 18(3), 320–334. https://doi.org/10.1037/a0032121

Appendix

Figure 3

Full model after removal of one indicator (Empathic concern 5).

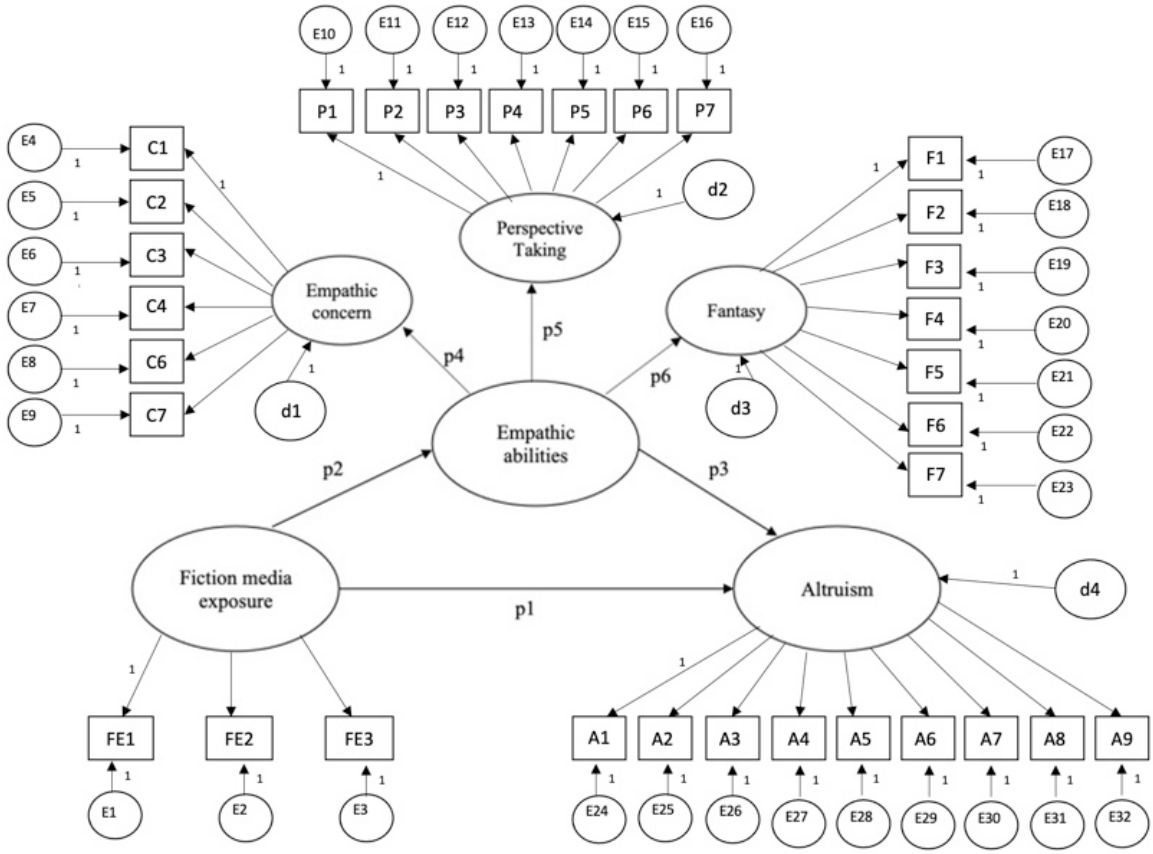


Table 3

Internal reliability measures (Cronbach's α and McDonald's ω) for each factor included in my models. Model 1 refers to the confirmatory model that included 32 indicators. Model 2 refers to the modified model that included 25 indicators.

Factor	Model 1 α	Model 1 ω	Model 2 α	Model 2 ω
Fiction media exposure	.90	.90	.90	.90
Altruism	.70	.71	.70	.71
Empathic concern	.77	.78	.78	.79
Perspective taking	.82	.82	.83	.83
Fantasy	.81	.81	.77	.77

Table 4

Item formulations and factor loadings. The presented loadings are the standardized factor loadings from the initial confirmatory analysis, prior to exploratory modifications. The (-) indicates that an item is reverse-keyed.

Item name	Item formulation	Factor loading
Empathic_concern_1	I often have tender, concerned feelings for people less fortunate than me	.77
Empathic_concern_2	Sometimes I don't feel very sorry for other people when they are having problems (-)	.33
Empathic_concern_3	When I see someone being taken advantage of, I feel kind of protective towards them	.63
Empathic_concern_4	Other people's misfortunes do not usually disturb me a great deal (-)	.37
Empathic_concern_5	When I see someone being treated unfairly, I sometimes don't feel very much pity for them (-)	Excluded as nonnormal
Empathic_concern_6	I am often quite touched by things that I see happen	.67
Empathic_concern_7	I would describe myself as a pretty soft-hearted person	.63
Perspective_taking_1	I sometimes find it difficult to see things from the "other guy's" point of view (-)	.45
Perspective_taking_2	I try to look at everybody's side of a disagreement before I make a decision	.68
Perspective_taking_3	I sometimes try to understand my friends better by imagining how things look from their perspective	.70
Perspective_taking_4	If I'm sure I'm right about something, I don't waste much time listening to other people's arguments (-)	.36
Perspective_taking_5	I believe that there are two sides to every question and try to look at them both	.69
Perspective_taking_6	When I'm upset at someone, I usually try to "put myself in his shoes" for a while	.68
Perspective_taking_7	Before criticizing somebody, I try to imagine how I would feel if I were in their place	.70

Fantasy_1	I daydream and fantasize, with some regularity, about things that might happen to me	.57
Fantasy_2	I really get involved with the feelings of the characters in a novel	.73
Fantasy_3	I am usually objective when I watch a movie or play, and I don't often get completely caught up in it (-)	.42
Fantasy_4	Becoming extremely involved in a good book or movie is somewhat rare for me (-)	.40
Fantasy_5	After seeing a play or movie, I have felt as though I were one of the characters	.68
Fantasy_6	When I watch a good movie, I can very easily put myself in the place of a leading character	.73
Fantasy_7	When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me	.75
Altruism_1	I have given money to a stranger who needed it (or asked me for it)	.49
Altruism_2	I have done volunteer work for a charity	.54
Altruism_3	I have donated blood	.48
Altruism_4	I have allowed someone to go ahead of me in a queue	.54
Altruism_5	I have pointed out a cashier's error (in a bank/shop) in undercharging me for an item	.57
Altruism_6	I have allowed someone I did not know that well to borrow an item of some value to me	.41
Altruism_7	I have bought 'charity' cards because I knew it was a good cause	.42
Altruism_8	I have helped a classmate I did not know that well with an assignment when my knowledge was greater than his/hers	.32
Altruism_9	I have offered to help a less able person across the street	.26

Table 5

Parameter estimates of the modified model. P1: fiction media exposure -> altruism; P2: fiction media exposure -> empathic abilities; P3: empathic abilities -> altruism; P4: empathic abilities -> empathic concern; P5: empathic abilities -> perspective taking; P6: empathic abilities -> fantasy.

Effect	Estimate	CI 95 %	SE	Standardized	*p*-value
P1	0.0261	0.015; 0.039	0.0060	.276	<.001
P2	0.0049	-0.011; 0.021	0.0081	.032	.586
P3	0.2946	0.192; 0.420	0.0600	.423	<.001
P4	1.000	1.000; 1.000	0.0000	.910	-
P5	0.643	0.481; 0.851	0.0937	.715	<.001
P6	0.589	0.436; 0.800	0.0921	.606	<.001

Table 6

Estimates of the direct and indirect effect (through empathic abilities) in the mediation analysis of the modified model.

Effect of fiction media exposure on altruism	Estimate	CI 95%	SE	Standardized	*p*-value
Direct effect (p1)	0.0261	0.015; 0.039	0.0060	.276	<.001
Indirect effect (p2*p3)	0.001	-0.003; 0.006	0.002	.014	.588