



HAL
open science

Disentangling between- and within-person associations between empathy and prosocial behaviours during early adolescence

Alexia Carrizales, Susan Branje, Lyda Lannegrand

► **To cite this version:**

Alexia Carrizales, Susan Branje, Lyda Lannegrand. Disentangling between- and within-person associations between empathy and prosocial behaviours during early adolescence. *Journal of Adolescence*, 2021, 93, pp.114-125. 10.1016/j.adolescence.2021.10.006 . hal-03642643

HAL Id: hal-03642643

<https://hal.science/hal-03642643>

Submitted on 5 Jan 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial | 4.0 International License

**Disentangling Between- and Within-person Associations between Empathy and
Prosocial Behaviours during Early Adolescence**

Alexia Carrizales^{a, c}, Susan Branje^b and Lyda Lannegrand^c

^a *Laboratory of Psychology EA3188, University Franche-Comté, Besançon, France*

^b *Department of Youth and Family, Utrecht University, Utrecht, The Netherlands*

^c *Laboratory of Psychology EA4139, University of Bordeaux, Bordeaux, France*

Author Note

Susan Branje: *s.branje@uu.nl*

Lyda Lannegrand: *lyda.lannegrand@u-bordeaux.fr*

Correspondence concerning this article should be addressed to Alexia Carrizales,
Laboratoire de Psychologie EA3188, Université Franche-Comté, 25000 Besançon,
France. Email: *alexiacarrizales1@gmail.com*

Declaration of interest: None.

Abstract

Introduction: Although empathy has been found to be related to prosocial behaviour, little is known about the longitudinal links between these two concepts during early adolescence, a unique window into developmental changes on empathy and prosocial behaviour considering the physical, cognitive, socio-emotional and contextual changes occurring during this period. Even though changes in adolescent empathy have been associated to changes in adolescent prosocial behaviour, studies examining this link on the within-person level are lacking. The present study investigated the within-adolescents longitudinal relations among empathy and prosocial behaviour.

Methods: 383 French adolescents ($M_{\text{ageT1}} = 12.15$, 50.4% male) reported on their empathy and prosocial behaviour each year across three years. In order to disentangle between-adolescent differences from within-adolescent processes, Random-Intercept Cross-Lagged Panel Models were applied.

Results: At the between-person level, there was a strong positive association between empathy and prosocial behaviour. At the within-person level, adolescents who reported more empathy than usual reported higher than usual prosocial behaviour one year later.

Conclusions: Adolescents with higher empathy compared to their peers tended to be those who reported higher prosocial behaviour. Changes in empathy within-adolescents were related to later within-adolescents' change in prosocial behaviour.

Keywords: Empathy – Prosocial behaviour – Early Adolescence – Random-intercept cross-lagged panel – Within-person level.

Disentangling Between- and Within-person Associations between Empathy and Prosocial Behaviour during Early Adolescence

Prosocial behaviour has been defined as voluntary, intentional actions that result in benefits for another individual or group (e.g., Caprara et al., 2015) and are considered as fundamental to the development of social competence and morality during childhood and adolescence (Eisenberg et al., 2015). A large body of empirical research has shown the beneficial role of prosocial behaviour not only for the target but also for the provider of prosocial behaviour (e.g., Eisenberg & Eggum, 2008). Adolescents who engage in prosocial behaviour have a range of positive personal outcomes such as higher self-esteem, self-efficacy, self-concept clarity, well-being (Fu et al., 2017; Zuffianò et al., 2016), agreeableness (Hilbig et al., 2014) and academic achievement (Gerbino et al., 2017). At the relational level, adolescents who engage in prosocial behaviour are more likely to have positive peer relationships and high friendship quality, are capable of managing social challenges, are more socially competent and have a higher sense of community and civic engagement (Boele et al., 2019). Moreover, prosocial behaviour is considered as a protective factor against externalising (e.g., aggression, delinquency), internalising (e.g., depressive symptoms, suicidal ideation) and relational problems (loneliness, discrimination, peer victimisation) (Davis et al., 2016; Griesse & Buhs, 2014; McDonald et al., 2011). It is therefore important to understand the factors that promote prosocial behaviour.

The reciprocal effects of empathy and prosocial behaviour

The bulk of theoretical literature suggests that prosocial behaviour is motivated by empathy, and several empirical studies have shown empathy and prosocial behaviour are associated (e.g., Decety et al., 2016; Hoffman, 2008). Nevertheless, still little is

known about the direction of effects between empathy and prosocial behaviour. Longitudinal research has identified adolescence as a sensitive period for the development of empathy and prosocial behaviour, yet longitudinal research on early adolescents is scarce. The aim of this study was to add to the extant literature by examining the effects between empathy and prosocial behaviour during early adolescence at the within-person level, while controlling for stable between-person differences.

Empathy should be seen as a complex multidimensional construct. The most common distinction is between ‘cognitive’ and ‘affective’ empathy (Cuff et al., 2016). Cognitive empathy refers to the understanding of another person’s feelings and relies on perspective taking or mentalising processes (Davis, 1983). Affective empathy includes sharing similar emotions (emotional contagion) or feeling sorrow or concern for the observed other (empathic concern) and to a lesser extent, emotional disconnection (Carré et al., 2013 ; Singer & Lamm, 2009). Affective and cognitive empathy are related (e.g., Jolliffe & Farrington, 2006; Van der Graaff et al., 2017) indicating that adolescents with a better understanding of others’ emotions are likely to also experience more shared feelings or empathic concern.

Research has shown correlations between empathy and prosocial behaviour (Eisenberg & Eggum, 2008; Hoffman, 2008). Some theoretical and empirical research, mainly cross-sectional, support that empathy is related to prosocial behaviour, these studies suggest that the affective and cognitive processes of empathy should provide the motivation to empathic action, i.e., helpful or prosocial actions, because in general, the individual helps someone who is in distress, pain, danger or other type of suffering (Decety et al., 2016; Siu et al., 2013). However, social cognitive theory posits that

exhibiting prosocial behaviour may also influence sociocognitive and socio-emotive tendencies, including empathy. First, engaging in prosocial behaviour provides adolescents with opportunities to take others' perspectives and show empathic concern (Malti et al., 2009). Second, prosocial behaviour elicit positive feedback from the environment, which may strengthen their social relationships and the image of themselves as a caring and understanding person, and may reinforce them to behave accordingly (Crocetti et al., 2016).

Research has shown that the transition from childhood to adolescence engenders physical, cognitive, socio-emotional and contextual changes (Steinberg & Morris, 2001) along with important social changes including the expansion of peer networks, interest in romantic relationships, and autonomy from families. It is a period of enhanced sensitivity for social experiences that might motivate certain behaviours, such as empathy-related responding (Blakemore & Mills, 2014). Indeed, studies have shown mean level increases in both empathy and prosocial behaviour during adolescence (Caprara et al., 2015 ; Davis & Franzoi, 1991 ; Eisenberg et al., 2005 ; Van der Graaff et al., 2014 ; Van der Graaff et al., 2017). Thus, early adolescence might represent a unique window into developmental changes that might have long-term consequences for the individual well beyond the adolescent years (Allemand et al., 2015).

To the best of our knowledge, few studies have examined the directionality of the effects between empathy and prosocial behaviour during adolescence. These studies showed that there are bidirectional relations between empathy and prosocial behaviour (Caprara et al., 2012; Carlo et al., 2015). A recent longitudinal study found that earlier prosocial behaviour was related to empathy-related traits, but only for females and that empathic concern mediated the relation between perspective taking and prosocial

behaviour (Van der Graaff et al., 2017).

The interplay among empathy and prosocial behaviour: disentangling between- and within-person associations

Although the few studies so far provide evidence of the expected bidirectional relations between empathy and prosocial behaviour, it should be noted that these studies have been based on statistics for between-person effects or aggregated within- and between-person effects. Thus, the practical implications of their findings to development at the individual level are unclear, considering that one should not equate between-person differences (i.e., whether group-level change in empathy is related to group-level change in prosocial behaviour) with within-person processes (i.e., whether individual-level change in empathy is related to individual-level change in prosocial behaviour) as these might differ in strength and direction (Curran et al., 2013; Hoffman & Stawski, 2009). For example, the fact that adolescents who report high levels of empathy than other adolescents are also likely to report higher prosocial behaviour does not necessarily imply that individual adolescents will experience higher prosocial behaviour when they improve their empathy. Only statistical analysis separating within-person effects from between-person allow one to make valid statements regarding within-person processes. This information could lead to practical implementations such as the innovation of prevention and intervention efforts in order to support optimal empathy and prosocial behaviour development in adolescents. Only within-person change can allow us to answer questions such as when individuals increase in empathy compared to before, does their prosocial behaviour subsequently change compared to their own prosocial behaviour before?

The present longitudinal study aimed to explore the effects between empathy

and prosocial behaviour in early adolescence at the within-person level while controlling for stable, between-person differences. Using state-of-the-art methodologies (i.e. Random-Intercept Cross-Lagged Panel Model; RI-CLPM, Hamaker et al., 2015), which allows to partition the variance of the observed scores into between and within-person variance and to examine cross-lagged relations at the within-person level. This approach is powerful considering that each adolescent acts as his/her own control, and any association between variables that remains results from adolescents' deviating from their own stable levels.

Gender differences

In addition, although gender differences in empathy and prosocial behaviour are consistently reported, there is a relative dearth of research on the role of gender in the bidirectional relations between empathy and prosocial behaviour (Allemand et al., 2015). Previous research suggests that gender was significantly related to the level of adolescents' prosocial behaviour and empathy, with males reporting lower levels of prosocial behaviour and empathy than females (e.g., Carlo et al., 2015; Crocetti et al., 2016; Eisenberg et al., 2005). These gender differences in empathy might support the notion that the interplay between empathic concern and prosocial behaviour has a stronger reinforcing quality for females relative to males (Carlo et al., 2007 ; Van der Graaff et al., 2014 ; Van der Graaff et al., 2017). Considering social expectations, gender stereotypes and gender-specific socialisation practices, it is possible that females are more encouraged to develop empathic skills and display greater empathy than males (e.g., Christov-Moore et al., 2014; Kite et al., 2008). This may not only result in differences in mean levels of prosocial behaviour and empathy but may also affect their bidirectional longitudinal relations. Thus, in the current study, we also examined

whether the pattern of longitudinal associations between empathy and prosocial behaviour differed for adolescent females and males.

The current Study

The purpose of the current study was to examine the longitudinal, within-person bidirectional relations between empathy and prosocial behaviour in early adolescence while controlling for trait-like differences at the between-person level. In this study when we use the term prosocial behaviour, we refer to a general prosocial disposition. To disentangle the direction of effects between empathy and prosocial behaviour, we explored cross-lagged relations, thereby controlling for concurrent associations and stability of empathy and prosocial behaviour when estimating bidirectional effects over time. We expected that empathy would be associated with subsequent prosocial behaviour, and that earlier prosocial behaviour would also be associated with subsequent empathy. In addition, we examined within-person associations between prosocial behaviour and empathy employing an innovative within-person analytical approach (RI-CLPM; Hamaker et al., 2015). It was expected that within-adolescents changes in empathy would be related to within-adolescent changes in prosocial behaviour and that within-adolescents changes in prosocial behaviour would be related to within-adolescent changes in empathy. Last, because of well-known gender differences in empathy and prosocial behaviour (Stuijzand et al., 2016 ; Van der Graaff et al., 2017), multigroup analyses across gender were performed. We expected that the bidirectional relations between empathy and prosocial behaviour would be stronger for females than for males.

Method

Participants and procedure

The data used in this study were part of a three-wave study (2014–2017) on the role of different contexts in empathy and prosocial behaviour development in adolescence. The waves were relatively equidistantly spaced, with the majority of the data collected annually in the same month as the first measurement time at each Junior High School participating in the study.

The sample consisted of 383 adolescents, 50.4% were males, the adolescents were in their 1st and 2nd year of Junior High School ($n = 383$; $M_{\text{age}} = 12.15$; $SD = 0.35$ at Time 1 (T1). There were no exclusionary criteria with respect to participant selection. The schools were recruited from the pool of all the junior high schools in Bordeaux (the capital of Gironde, on the 6th place among 34971 municipalities in France by demographic size). Access to this pool is available from the website of the French Ministry of Education. In order to broaden the population of interest, five junior high schools from different parts of Bordeaux metropolitan area were selected.

Adolescents and their parents received written information about the research prior to the study; the possibility of not participating was also explained in this letter. Parents and adolescents provided written informed consent, and written informed consent was also obtained from the schools. Adolescents were assessed three times, respectively at T1, T2 and T3 with 1-year intervals by filling out a battery of questionnaires at school after school hours. Confidentiality was guaranteed explicitly. Research assistants gave verbal instructions to the adolescents to complement the written instructions printed above each questionnaire. Completing the questionnaires lasted an hour. Adolescents received no reward for any wave they participated in.

In total, the percentage of missing data across waves and variables was 6.88%. The percentage of missing values across the prosocial behaviour and empathy variables ranged between 1.1% and 12.5% respectively. The patterns of missingness were related to the fact that of the 383 adolescents, 47 were not present the day of the first measurement wave. Most of these 47 adolescents were males ($n = 33$) and in 7th grade at the first wave. In our analyses these two variables have been considered, specifically, gender in the multigroup analyses and grade at first wave in the sensitivity analyses. Therefore, although Little's (1988) missing completely at random test was significant, $\chi^2(37) = 75.44, p = <.001$, the normed chi-square (χ^2/df) of 2.04 showed a good fit between the imputed and non-imputed sample scores, suggesting the pattern of missing data values was completely random (Bollen, 1989). In order to deal with the missing data, full information maximum likelihood (FIML) with robust estimates (MLR) in Mplus version 8.1 was used (Enders & Bandalos, 2001; Muthén & Muthén, 2017). The full-information maximum likelihood method is regarded as the method of choice for estimating missing data because it yields more accurate results than other approaches by minimising bias in regression and standard error estimates for all types of missing data when the amount of missing data is not larger than 20% (Schlomer et al., 2010).

Measures

Empathy

In order to assess adolescents' perception of their own empathy, we used the **Basic Empathy Scale** (BES, Jolliffe & Farrington, 2006), a 20-item questionnaire rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The scale was adapted in French by Carré et al. (2013). It includes three dimensions: emotional contagion (6 items, e.g. 'I get caught up in other people's feeling easily'),

cognitive empathy (8 items, e.g. ‘I can understand my friend’s happiness when she/he does well at something’) and emotional disconnection (6 items, ‘I am not usually aware of my friend’s feelings’). To assess the psychometric validity of the three-factor structure on our sample, a CFA was performed, suggesting a good model fit, $\chi^2(116, N = 1545) = 879.25, p < .001$, RMSEA = .06 [0.06-0.07], CFI=.95, WRMR = 1.81. The three-factor structure was supported except for three items (item 15 from emotional contagion with factor loading lower than .30, and items 6 and 20 from cognitive empathy loading on more than one dimension). All items were mean scored to create a composite to reflect empathy. Omega coefficients for the composite scales can be found in Table 1.

Prosocial Behaviour

Adolescents reported on their own prosocial behaviour toward others using a validated French adaptation (Carrizales et al., 2017) of the **Prosocial Behaviour Scale (PBS)** (Caprara et al., 2005). The French version assesses two types of prosocial behaviours: helping (6 items, e.g., ‘I try to help others’) and caring (8 items, e.g., ‘I try to be close to and take care of those who are in need’) on a 5-point Likert scale ranging from 1 (*never/almost never*) to 5 (*almost always/always*). In the present study, in order to avoid possible overlap among items of the caring dimension and the empathy scale, only four items¹ for the caring dimension were used. All items were mean scored to create a composite to reflect prosocial behaviour. Omega coefficients for these composite scales can be found in Table 1.

Analytic Strategy

¹ We excluded the following items: Item 5: I’m empathic with those who are in need, Item 8: I intensity feel what others feel, Item 12: I easily put myself in the shoes of those who are in discomfort, Item 16: I immediately sense my friends’ discomfort even when it is not directly communicated to me.

The research questions were examined with three types of analyses: (1) standard cross-lagged panel models (CLPM), (2) Random-Intercept cross-lagged panel models (RI-CLPM) and (3) Multigroup analyses (MG) with Mplus Version 8.1 (Muthén & Muthén, 2017).

To address our primary aim whether adolescents' empathy would be related to later changes in prosocial behaviour and whether adolescents' prosocial behaviour would be related to later changes in empathy, first, only for comparison purposes, a 'standard' cross-lagged panel model with bidirectional paths between empathy and prosocial behaviour was estimated, aggregating the between and within-person source of variance. For the sake of parsimony and to maximise measurement equivalence of the constructs across waves, we tested whether the stability paths, cross-lagged effects and within-time correlations were time invariant and could therefore be constrained over time, reducing the model complexity (Hamaker et al., 2015).

To examine our aim whether adolescents' empathy would be related to later within-person changes in prosocial behaviour and whether adolescents' prosocial behaviour would be related to later within-person changes in empathy, a Random-Intercept Cross-Lagged Panel Model (Hamaker, 2018; Hamaker et al., 2015) was used. This model separates the within-person variance from stable between-person differences through the inclusion of random intercepts. Before conducting these analyses, we examined if there was sufficient variance at the within-person (i.e., fluctuations of the same adolescents over time) and between-person level (i.e., differences between adolescents) by calculating the intraclass correlation coefficients (ICCs). The calculation of the ICC used in this study followed the same steps used in multilevel analyses. 'The individual data are decomposed into two separate models for the within

and between groups structures. The total score is decomposed into an individual component (i.e., the individual deviation from the group mean) and a group component (i.e., the disaggregated group mean). This individual decomposition is used to compute separate within-and between-group covariances matrixes' (Heck, 2001, p.98).

For the RI-CLPM, at the between-person level, fixed effects (i.e., random intercepts) were included, which accounted for time-invariant trait-like individual differences. At the within-person level, an individual's deviation from his or her typical level, which was not explained by the between-person latent variable (i.e., random intercept) was accounted for using the within-person structural residuals (Curran et al., 2013). Consistent with the random-intercept cross-lagged panel model, we created (a) the within-person centred variables for empathy and prosocial behaviour at all three waves; (b) specified autoregressive and cross-lagged pathways between the within-person centred variables; and (c) estimated the covariances between the within-person centred variables at each time point (see Hamaker, 2018, for more information on specifying RI-CLPM models). Given the changes in empathy and prosocial behaviour shown by previous studies (Eisenberg & Eggum, 2008; Van der Graaff et al., 2017), the means and intercepts were allowed to vary freely across time (Hamaker et al., 2015). Finally, the measurement error variances of the observed scores were constrained to zero. Thus, all variation in the observed measures was completely captured by the within-person and between-person latent factor structure.

After determining which model best represented the data of the total sample, a multigroup approach was used in all analyses to examine whether CLPM and RI-CLP model significantly differed between males and females. The square difference test ($\Delta S-B\chi^2$) was used to compare a multi-group model, which constrained the parameters

across adolescent gender to be equal with a model that allowed the parameters to vary across adolescent gender. If the setting of different paths as equal did not significantly worsen the model fit, there were no significant differences between the two groups, indicating that interplay between empathy and prosocial behaviour is similar for females and males and we used the constrained models. To assess model fit, several goodness-of-fit indices were used including the Akaike Information Criterion (AIC), the Bentler Comparative Fit Index (CFI), the root mean square error of approximation (RMSEA), and the Standardised Root Mean square Residual (SRMR). Generally, lowest AIC, CFI values larger than .95, RMSEA values smaller than .05 and SRMR values smaller than .08 indicate good model fit (Akaike, 1974; Kline, 2016).

Results

Preliminary Analyses

Means, SDs and correlations of the study variables can be found in Table 1. Prosocial behaviour and empathy were positively related at each time point ($r = .49$, $r = .54$, $r = .51$) at T1, T2 and T3 respectively.

Insert Table 1 here

Standard Cross-Lagged Panel Model (CLPM)

To examine the bidirectional relations between empathy and prosocial behaviour, a cross-lagged panel model was estimated. The model fit was good $S-B\chi^2(4) = 7,561$, $p = .10$, CFI = .99, RMSEA = .05, SRMR = .02. The CLPM results are depicted in Figure 1. Model comparisons indicated that the stability path, cross-lagged effects, and within-time correlations were time invariant and could be constrained over time

without worsening the model fit. The constrained CLPM showed good fit: $S-B\chi^2(10) = 19.192, p < .05, CFI = .97; RMSEA = .05, SRMR = .07$. The detailed parameters estimates are reported in Table 2.

Insert Figure 1 here

As seen in Table 1, significant positive cross-lagged effects emerged from empathy at Wave 1 and Wave 2, to prosocial behaviour at Wave 2 and Wave 3, adolescents who reported higher empathy at Wave 1 and Wave 2, compared to their peers, tended to also report higher levels of prosocial behaviour at Wave 2 and 3 respectively. Moreover, in order to test the difference in size of different cross-lagged parameters (i.e., the ones from empathy to prosocial behaviour with the ones from prosocial behaviour to empathy), these cross-lagged paths were constrained to be equal, and the model fit of this constrained model $S-B\chi^2(11) = 23.728, p = .01, CFI = .97; RMSEA = .05, SRMR = .08$ was compared with the freely estimated model in terms of their model fit indices. According to the chi-square difference test, the effects of the cross-lagged parameters could not be constrained to be equal, $\Delta S-B\chi^2(1) = 5.426, p = .020$, suggesting that the effect from empathy to prosocial behaviour was stronger than the effect from prosocial behaviour to empathy.

Within-person effects between empathy and prosocial behaviour

To test whether the statistical effects found with the ‘standard’ cross-lagged model reflect within-person linkages or between-person differences, first, the extent to which there is sufficient variance at within- and between-person levels were examined by calculating the ICC. The ICCs suggested that a substantial part of the variance in

empathy and prosocial behaviour was located at the within-level. The exact estimates were: 40.6% for empathy and 38.6% for prosocial behaviour. Hence, a small portion of the variation is due to stable differences between adolescents. In other words, a substantial part of the variation observed (59.40% to 61.4%) was due to fluctuations over time in adolescents' reports of empathy and prosocial behaviour and not to stable between-person differences.

The fit of the initial, unconstrained RI-CLPM showed good fit $S-B\chi^2(2) = .105$, $p = .95$, RMSEA = .00, CFI=1.0, SRMR = .01. Model comparisons indicated that the stability paths (except for empathy), cross-lagged effects, and within-time correlations were time invariant and could be constrained over time. The RI-CLPM is depicted in Figure 2. The model demonstrated excellent model fit: $S-B\chi^2(5) = 5.867$, $p = 0.32$, RMSEA = .02, CFI = 1.0, SRMR = .03.

To evaluate whether the differentiated RI-CLPM fit our data better than the CLPM, the fit of both models was compared using the Akaike Information Criterion (AIC). The lower AIC suggested that the inclusion of the random intercept improved the model fit (AIC = 3678.760) compared with the cross-lagged panel model (AIC = 3685.998). The AIC favoured the more complex model, suggesting it provided a better representation of the data.

Insert Figure 2 here

The results revealed that, at the between-person level, there was a strong positive association between empathy and prosocial behaviour, $r = .86$, $p < .05$, indicating that

adolescents who reported higher empathy compared to other adolescents, tended to also report higher prosocial behaviour compared to their peers.

At the within-person level, only the autoregressive paths from empathy across time were statistically significant. Adolescents who's scored higher than their expected score on empathy were likely to subsequently score higher than their expected score as well, providing support for within-person carry-over effects. The cross-lagged parameters suggested that adolescents who reported more empathy than their expected/average score were related to higher than average scores on adolescents' prosocial behaviour one year later. Meanwhile, an adolescent's deviation in prosocial behaviour was not related to the deviation in adolescent's empathy. The detailed parameter estimates are reported in Table 2.

Insert Table 2

Multi-Group Analysis

We conducted a multigroup analysis to examine the group differences (female vs male) in reciprocal relations between empathy and prosocial behaviour.

A fixed CLPM with both autoregressive paths and cross-lagged paths constrained to be equal across groups, was compared with the freely estimated model in terms of their model fit indices. The two groups did not demonstrate a significant difference according to the chi-square difference test $\Delta S-B\chi^2 (17) = 22.26, p = .175$. The fit of the CLPM gender constrained model was good $S-B\chi^2 (25) = 33.625, p = .12$, CFI= .97; RMSEA=.04, SRMR = .13.

The unconstrained RI-CLPM fit was good $S-B\chi^2(4) = 1.70, p = .79, CFI = 1.0, RMSEA = .01, SRMR = .03$. All the paths could be constrained without worsening the model fit. The two groups did not demonstrate a significant difference according to the chi-square difference test $\Delta S-B\chi^2(10) = 12.46, p = .255$. The fit of the RI-CLPM gender constrained model was good $S-B\chi^2(14) = 14.01, p = .45, CFI = 1.0, RMSEA = .00, SRMR = .05$. In both CLPM and RI-CLP models, constraining the parameters across gender did not contribute to significant model fit change, reflecting non-significant differences in effects between females and males. Adolescent gender did not appear to moderate any associations that were investigated.

Sensitivity Analyses

Sensitivity analyses were conducted to explore whether results are robust when controlling for adolescent grade at first wave. Table A.1 in the Appendix A presents the fit indices for the initial models (CLPM, RI-CLPM) and the best fitting alternative models (either standard CLPM or RICLPM-constrained), after controlling for adolescent grade at first wave, by regressing the observed scores of empathy and prosocial behaviour on grade at first wave. As can be seen by comparing those estimates with the models without covariates, only few minor changes emerged on the CLPM and they mostly referred to the autoregressive stability of prosocial behaviour, which decreased between the first and second waves in the models with covariates (Table A. 2, Appendix A). All other parameter estimates remained largely unchanged, which indicates that the substantive results of this study also hold when controlling for adolescent grade at first wave.

Discussion

This study examined how empathy and prosocial behaviour are associated to each other over time at the within-person, state-like level, while controlling for trait-like differences at the between-person level. We did so by using a RI-CLPM (Hamaker et al., 2015) and compared the results with the most commonly used method so far, the standard CLPM (Mund & Nestler, 2018). Without separating the within-person and between-person effects, results of the autoregressive, standard cross-lagged panel model analyses demonstrated a reciprocal association between empathy and prosocial behaviour over time, suggested that there were significant positive cross-lagged effects of empathy on prosocial behaviour and vice-versa. This suggests that adolescents who report higher empathy relative to their peers are also expected to show higher prosocial behaviour over time and adolescents who report higher prosocial behaviour relative to their peers are also expected to be more empathic over time. Overall, the associations at the between-person level were in accordance with previous studies (e.g., Van der Graaff et al., 2017). However, to the best of our knowledge, studies clarifying whether the identified reciprocal associations were due to between-person differences or within-person fluctuations is lacking. Our results suggest that when these longitudinal associations were tested at the within-adolescent level, while controlling for stable differences and associations at the between-adolescent level, the results showed that at the within-person level, adolescents' empathy was related to within-person changes in prosocial behaviour over time but prosocial behaviour was not related to within-person changes in empathy, after controlling for stable between-person differences. In addition, these processes were found to be similar for males and females. The comparison of the results of the two types of models highlights the necessity of going beyond rank-order

changes in empathy and prosocial behaviour in understanding the ‘true’ nature of their associations over time.

Consistent with the hypothesis, these results showed that adolescents’ empathy was related to later changes in their prosocial behaviour. This is in line with empirical studies from sociocognitive developmental approaches and social neuroscience theories, which supports the idea that empathy drives prosocial behaviour (Batson, 2009; Benita et al., 2017; Decety et al., 2016; Eisenberg et al., 2015). It further confirms previous research showing that individuals who are less empathic toward others are less inclined to behave prosocially in a variety of different scenarios (Batson, 2010; Batson et al., 2007; Decety et al., 2016; Hein & Singer, 2008; Masten et al., 2011; Morelli et al., 2017).

The current research extends these studies by demonstrating the effects of empathy on changes in prosocial behaviour at the within-person level. We found that early adolescents’ empathy was related to within-adolescent changes in prosocial behaviour over time, that is, adolescents’ changes in empathy, compared to their own empathy, were positively related to change in their prosocial behaviour. It suggests that the propensity to empathise with others might be one of the mechanisms underlying development of prosocial behaviour.

In addition, the results of RI-CLPM showed that within-adolescent change in empathy and prosocial behaviour were correlated. This means that within-adolescent changes in empathy were associated with within-adolescent changes in prosocial behaviour. Thus, if adolescents’ empathy change, for instance, empathy increases, this should be related to adolescents’ prosocial behaviour. The positive results on the within-

adolescents level indicate that, during early adolescence, fluctuations in adolescents' empathy were related to adolescents' prosocial behaviour change over time.

An important aspect to keep in mind is that the reported within-person effects of empathy on prosocial behaviour reflect averaged within-person effects. There is considerable within-adolescent heterogeneity in the processes that link empathy to prosocial behaviour, and future studies may explain this heterogeneity in within-person effects.

Contrary to our expectations, the pattern of longitudinal associations between prosocial behaviour and empathy did not differ between early adolescents' males and females in the standard cross-lagged-panel models nor in the random-intercept cross-lagged panel models. The main focus of the present study, however, was on the longitudinal associations among the study variables. The issue of gender differences in the interplay among empathy and prosocial behaviour maybe more complex, since other studies found mixed results. The study by Van der Graaff et al. (2017) examined the interplay among empathy concern, perspective taking and prosocial behaviour and only found a moderation of adolescents' gender in the association between prosocial behaviour and empathy concern. Specifically, they found this association to be limited to females only. This finding can be interpreted in the context of gender role expectations, in contrast to perspective taking, males are more likely to report lower scores of empathic concern and be less affected than females that may be influenced to a larger extent by environmental variables, such as the parental and peer environment.

The results for the standard CLPM used for comparison purposes that aggregates between-and-within-person variances revealed that empathy and prosocial behaviour were positively related over time, with the effect of empathy on prosocial behaviour

being stronger than the reciprocal effect of prosocial behaviour on empathy. In contrast, the RI-CLPM that allows to examine how empathy and prosocial behaviour influence each other at the within-adolescent level while controlling for between-adolescents differences, showed that only adolescents' empathy was related to within-adolescents changes in their prosocial behaviour over time. Thus, once we accounted for adolescents' trait-like stability in each of these constructs via the inclusion of the random intercepts, these cross-lagged effects of prosocial behaviour were no longer significant.

Our results evidence that at the between-person level there was a reciprocal pattern of associations between empathy and prosocial behaviour over time. These associations between empathy and prosocial behaviour over time might be accounted for by stable personal characteristics (e.g., personality traits), considering that the between-person effects often reflect the more trait-like effects, whereas the within-person effects often reflect the more state-like effects (Zhou et al., 2020). Future studies are needed to identify the specific factors that may account for the current identified between-person associations between empathy and prosocial behaviour.

In addition, the within-person-effects address the extent to which an individual's behaviour at any time point deviates from their typical average and the extent to which those deviations are related within an individual. We found positive associations between empathy and prosocial behaviour within each time point and across time, indicating that empathy was related to later prosocial behaviour rather than the reverse. The within-person findings suggest that adolescents' higher level of empathy at one grade level was linked to their relatively higher level of prosocial behaviour at the next grade level. Importantly, such findings were based on three annual waves of data across

the entire early adolescence period and the patterns of within-person effects between empathy and prosocial behaviour were quite consistent across time lags. However, the optimal time lag is not yet clear and this issue requires more systematic attention in future research. Although some psychological attributes may change in the short-term, such that for example daily experiences lead to daily changes in behaviour, other psychological attributes might only change on the longer term after repeating experiences that accumulate and lead to changes in attitudes or general tendencies. The selection of the time lag for this study was based on the common lag chosen by studies related to the constructs under investigation, that allows us to observe and capture most substantial changes. The measures of prosocial behaviour and empathy used in the current study assess empathic and prosocial tendencies rather than very specific prosocial or empathic behaviours.

Limitations, Strengths and Future Directions

The results should be interpreted considering some limitations. First, despite the longitudinal design and the insights gained of the direction of effects, no causal conclusion can be drawn considering that it is impossible to exclude the possibility that particular associations are due to variables that were not measured in the study design. Another caveat is that the data were based on self-reported paper and pencil measures, thus shared method and informant variance might inflate the identified effects, although utilising the cross-lagged approach somewhat reduced this concern by accounting for autoregressive effects and although the findings were generally consistent with prior research, future research will benefit from using multiple methods designs (e.g. observational) and multi-informant measures. Moreover, as in any longitudinal study, the period of the time lags between each wave warrant discussion. It is important to

clarify that the processes that may underlie the bidirectional within-adolescent associations between empathy and prosocial behaviour may be different on the short-term and on the long-term, and inconsistency of estimates across studies could be partially explained by differences in the time lag (e.g., Kuiper & Ryan, 2018; Orth et al., 2021). Therefore, investigating processes at different time lags in panel designs is important, considering that convergence, fit, consistence of estimates, and cross-lagged regression coefficients might vary, depending on the respective time lags between different sets of measurement occasions, and on whether the time lag between waves is appropriate for the substantive research question (Dormann & Griffin, 2015; Orth et al., 2021).

Consequently, this can lead to researchers drawing conflicting conclusions regarding the sign or dominance of relations. Future research should examine this issue in more detail, for example, by applying short-time optimal lag or continuous-time models (Dormann & Griffin, 2015; Kuiper & Ryan, 2018). In addition, longitudinal studies with longer follow-up than used in the present study are needed.

Notwithstanding these limitations, the current study has resulted in new insights and important avenues for future research into within-individual empathy and prosocial behaviour associations during early adolescence. It shows long-term associations of empathy on prosocial behaviour. So far, the empathy-prosocial behaviour links have been examined through models assessing aggregated between – and within person effects. To the best of our knowledge, this is the first study to have made use of RI-CLPM to disentangle and examine between-person differences and within-person processes. Indeed, by using this new technique, we were able to examine within-person changes and our results reveal that adolescents' empathy was related to within-person

changes in their prosocial behaviour over time and this finding could lend support to interventions that aim to improve adolescents' prosocial behaviour by targeting empathy. The identified within-person effects from empathy to increases in prosocial behaviour over time suggest that ameliorating adolescents' empathy may produce corresponding improvements in their prosocial behaviour. In addition, this study focused on empathy and prosocial behaviour in early adolescence where research is still scarce and which is an important developmental period for empathy and prosocial behaviour. This implication is unique given that prior research has primarily focused on between-person comparisons and although the between-person comparisons can demonstrate the link between empathy and prosocial behaviour across individuals, it provides little evidence showing that the changes in empathy within an individual may actually be associated with the corresponding changes in his or her prosocial behaviour (Curran & Hancock, 2021)

Future research should continue to move beyond a unidimensional approach of prosocial behaviour in an attempt to more accurately capturing the multidimensional nature of prosocial behaviour (Carrizales et al., 2017). This could be reached by acknowledging the different types of prosocial behaviour related to different situational contexts (Carlo & Randall, 2001), by how prosocial behaviour differs according to the target of the behaviour, such as family, friends, and strangers (Padilla-Walker et al., 2015). Similarly, some studies on empathy that considered variables such as the group context, the personal motivations and the situational factors found that among stable social groups, patterns of empathic responding might be relatively consistent across time and context (Gutsell & Inzlicht, 2012).

Conclusions and Implications

The present study offers relevant new insights for understanding the within-person processes in the development of early adolescents' empathy and prosocial behaviour. This study represents the first examination disaggregating within-person and between-person effects in the association between empathy and prosocial behaviour. Moreover, it expands and contributes to current knowledge examining bidirectional longitudinal associations between empathy and prosocial behaviour during early adolescence. Results suggest that the contribution of empathy to early adolescents' prosocial behaviour over time may be attributable to both the more stable, trait-like differences between individuals and the more state-like fluctuations within individuals. These results have important theoretical and practical implications. The positive results on the within-person level call for further empirical research regarding the time scale at which developmental processes, such as the one studied here, take place. From a practical perspective, for example, prevention and intervention programmes interested in enhancing adolescents' prosocial behaviour should consider empathy as the main proximal target and a potential avenue of intervention strategies, as our results suggested that empathy is a driver of prosocial behaviour.

References

- Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, 19(6), 716-723.
<https://doi.org/10.1109/TAC.1974.1100705>
- Allemand, M., Steiger, A. E., & Fend, H. A. (2015). Empathy development in adolescence predicts social competencies in adulthood. *Journal of Personality*, 83(2), 229-241. <https://doi.org/10.1111/jopy.12098>
- Batson, C. D. (2009). These things called empathy: Eight related but distinct phenomena. In J. Decety & W. Ickes (Eds.), *The social neuroscience of empathy* (pp. 3–15). MIT Press. <https://doi.org/10.7551/mitpress/9780262012973.003.0002>
- Batson, C. D. (2010). Empathy-induced altruistic motivation. In M. Mikulincer, & P. R. Shaver (Eds.), *Prosocial motives, emotions, and behavior: The better angels of our nature*. (pp. 15-34). <https://doi.org/10.1037/12061-001>
- Batson, C. D., Eklund, J. H., Chermok, V. L., Hoyt, J. L., & Ortiz, B. G. (2007). An additional antecedent of empathic concern: Valuing the welfare of the person in need. *Journal of Personality and Social Psychology*, 93(1), 65-74.
<https://doi.org/10.1037/0022-3514.93.1.65>
- Benita, M., Levkovitz, T., & Roth, G. (2017). Integrative emotion regulation predicts adolescents' prosocial behavior through the mediation of empathy. *Learning and Instruction*, 50, 14-20.
- Blakemore, S. J., & Mills, K. L. (2014). Is adolescence a sensitive period for sociocultural processing? *Annual Review of Psychology*, 65, 187-207.

- Boele, S., Van der Graaff, J., de Wied, M., Van der Valk, I. E., Crocetti, E., & Branje, S. (2019). Linking Parent–Child and Peer relationship quality to empathy in adolescence: A Multilevel Meta-Analysis. *Journal of Youth Adolescence, 48*(6), 1033-1055. <https://doi.org/10.1007/s10964-019-00993-5>
- Bollen, K. A. (1989). *Structural equations with latent variables*. John Wiley & Sons. <https://doi.org/10.1002/9781118619179>
- Caprara, G. V., Alessandri, G., & Eisenberg, N. (2012). Prosociality: The contribution of traits, values, and self-efficacy beliefs. *Journal of Personality and Social Psychology, 102*(6), 1289-1303. <https://doi.org/10.1037/a0025626>
- Caprara, G. V., Luengo Kanacri, B. P., Zuffianò, A., Gerbino, M., & Pastorelli, C. (2015). Why and how to promote adolescents' prosocial behaviors: Direct, mediated and moderated effects of the CEPIDEA school-based program. *Journal of Youth and Adolescence, 44*(12), 2211-2229. <https://doi.org/10.1007/s10964-015-0293-1>
- Caprara, G. V., Steca, P., Zelli, A., & Capanna, C. (2005). A new scale for measuring adults' prosocialness. *European Journal of Psychological Assessment, 21*(2), 77-89. <https://doi.org/10.1027/1015-5759.21.2.77>
- Carlo, G., Crockett, L. J., Randall, B. A., & Roesch, S. C. (2007). A latent growth curve analysis of prosocial behavior among rural adolescents. *Journal of Research on Adolescence, 17*(2), 301-324. <https://doi.org/10.1111/j.1532-7795.2007.00524.x>
- Carlo, G., Padilla-Walker, L. M., & Nielson, M. G. (2015). Longitudinal bidirectional relations between adolescents' sympathy and prosocial behavior. *Developmental Psychology, 51*(12), 1771-1777. <https://doi.org/10.1037/dev0000056>

- Carlo, G., & Randall, B. A. (2001). Are all prosocial behaviors equal? A socioecological developmental conception of prosocial behavior. In F. Columbus (Ed.), *Advances in psychology research*, Vol. II (pp. 151-170). Nova Science Publishers.
- Carré, A., Stefaniak, N., D'Ambrosio, F., Bensalah, L., & Besche-Richard, C. (2013). The basic empathy scale in adults (BES-A): Factor structure of a revised form. *Psychological Assessment*, 25(3), 679-691. <https://doi.org/10.1037/a0032297>
- Carrizales, A., Perchec, C., & Lannegrand-Willems, L. (2017). Brief report: How many dimensions in the prosocial behavior scale? Psychometric investigation in French-speaking adolescents. *European Journal of Developmental Psychology*, 1-9. <https://doi.org/10.1080/17405629.2017.1419952>
- Christov-Moore, L., Simpson, E. A., Coudé, G., Grigaityte, K., Iacoboni, M., & Ferrari, P. F. (2014). Empathy: Gender effects in brain and behavior. *Neuroscience & Biobehavioral Review*, 46(4), 604-627.
- Crocetti, E., Moscatelli, S., Van der Graaff, J., Rubini, M., Meeus, W., & Branje, S. (2016). The interplay of Self-Certainty and prosocial development in the transition from late adolescence to emerging adulthood. *European Journal of Personality*, 30(6), 594-607. <https://doi.org/10.1002/per.2084>
- Cuff, B., Brown, S., Taylor, L., & Howat, D. (2016). Empathy: A review of the concept. *Emotion Review*, 8(2), 144-153. <https://doi.org/10.1177/1754073914558466>
- Curran, P. J., & Hancock, G. R. (2021). The challenge of modeling co-developmental processes over time. *Child Development Perspectives*, 15(2), 67-75. <https://doi.org/https://doi.org/10.1111/cdep.12401>

- Curran, P., Howard, A., Bainter, S., Lane, S., & McGinley, J. (2013). The separation of Between-Person and Within-Person components of individual change over time: A latent curve model with structured residuals. *Journal of consulting and clinical psychology, 82*. <https://doi.org/10.1037/a0035297>
- Davis, A. N., Carlo, G., Schwartz, S. J., Unger, J. B., Zamboanga, B. L., Lorenzo-Blanco, E. I., Cano, M. Á., Baezconde-Garbanati, L., Oshri, A., Streit, C., Martinez, M. M., Piña- Watson, B., Lizzi, K., & Soto, D. (2016). The longitudinal associations between discrimination, depressive symptoms, and prosocial behaviors in U.S. Latino/a recent immigrant adolescents. *Journal of Youth and Adolescence, 45*(3), 457-470. <https://doi.org/10.1007/s10964-015-0394-x>
- Davis, M. H. (1983). The effects of dispositional empathy on emotional reactions and helping: A multidimensional approach. *Journal of Personality, 51*(2), 167-184. <https://doi.org/10.1111/j.1467-6494.1983.tb00860.x>
- Davis, M. H., & Franzoi, S. L. (1991). Stability and change in adolescent self-consciousness and empathy. *Journal of Research in Personality, 25*(1), 70-87. [https://doi.org/10.1016/0092-6566\(91\)90006-C](https://doi.org/10.1016/0092-6566(91)90006-C)
- Decety, J., Bartal, I., Uzefovsky, F., & Knafo-Noam, A. (2016). Empathy as a driver of prosocial behaviour: Highly conserved neurobehavioural mechanisms across species. *Philosophical Transactions of the Royal Society B: Biological Sciences, 371*, 20150077. <https://doi.org/10.1098/rstb.2015.0077>
- Dormann, C., & Griffin, M. A. (2015). Optimal time lags in panel studies. *Psychological Methods, 20*(4), 489-505. <https://doi.org/10.1037/met0000041>

Eisenberg, N., Cumberland, A., Guthrie, I. K., Murphy, B. C., & Shepard, S. A. (2005).

Age changes in prosocial responding and moral reasoning in adolescence and early adulthood. *Journal of Research on Adolescence*, 15(3), 235-260.

<https://doi.org/10.1111/j.1532-7795.2005.00095.x>

Eisenberg, N., & Eggum, N. D. (2008). Empathy-related and prosocial responding:

Conceptions and correlates during development. In B. A. Sullivan, M. Snyder, & J. L. Sullivan (Eds.), *Cooperation: The political psychology of effective human interaction*. (pp. 53-74). Blackwell Publishing.

Eisenberg, N., Spinrad, T. L., & Knafo-Noam, A. (2015). Prosocial development. In M.

E. Lamb, & R. M. Lerner (Eds.), *Handbook of child psychology and developmental science: Socioemotional processes, Vol. 3, 7th ed.* (pp. 610-656).

John Wiley & Sons Inc.

Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models.

Structural Equation Modeling: A Multidisciplinary Journal, 8(3), 430-457.

https://doi.org/10.1207/S15328007SEM0803_5

Fu, X., Padilla-Walker, L. M., & Brown, M. N. (2017). Longitudinal relations between

adolescents' self-esteem and prosocial behavior toward strangers, friends and family. *Journal of Adolescence*, 57, 90-98.

Gerbino, M., Zuffianò, A., Eisenberg, N., Castellani, V., Luengo Kanacri, B. P.,

Pastorelli, C., & Caprara, G. V. (2017). Adolescents' prosocial behavior predicts good grades beyond intelligence and personality traits. *Journal of Personality*,

86: 247-260. <https://doi.org/10.1111/jopy.12309>

- Griese, E. R., & Buhs, E. S. (2014). Prosocial behavior as a protective factor for children's peer victimization. *Journal of Youth and Adolescence*, *43*(7), 1052-1065. <https://doi.org/10.1007/s10964-013-0046-y>
- Gutsell, J. N., & Inzlicht, M. (2012). Intergroup differences in the sharing of emotive states: Neural evidence of an empathy gap. *Social Cognitive and Affective Neuroscience*, *7*(5), 596-603. <https://doi.org/10.1093/scan/nsr035>
- Hamaker, E. L. (2018). *How to run the RI-CLPM with Mplus*. Available from: https://www.researchgate.net/publication/323935149_How_to_run_the_RI-CLPM_with_Mplus. Accessed January 3, 2020.
- Hamaker, E. L., Kuiper, R. M., & Grasman, R. P. P. P. (2015). A critique of the cross-lagged panel model. *Psychological Methods*, *20*(1), 102-116. <https://doi.org/10.1037/a0038889>
- Heck, R. (2001). Multilevel modeling with SEM. In G.A.Marcoulides, R.E Schumacker (Eds.), *New developments and techniques in structural equation modeling* (pp. 89-128). Lawrence Erlbaum Associates
- Hein, G., & Singer, T. (2008). I feel how you feel but not always: the empathic brain and its modulation. *Current Opinion in Neurobiology*, *18*(2), 153-158. <https://doi.org/10.1016/j.conb.2008.07.012>
- Hilbig, B. E., Glöckner, A., & Zettler, I. (2014). Personality and prosocial behavior: Linking basic traits and social value orientations. *Journal of Personality and Social Psychology*, *107*(3), 529-539. <https://doi.org/10.1037/a0036074>
- Hoffman, L., & Stawski, R. S. (2009). Persons as contexts: Evaluating between-person and within-person effects in longitudinal analysis. *Research in Human Development*, *6*(2-3), 97-120. <https://doi.org/10.1080/15427600902911189>

- Hoffman, M. L. (2008). Empathy and prosocial behavior. In Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions*. (pp. 440-455). The Guilford Press.
- Jolliffe, D., & Farrington, D. P. (2006). Development and validation of the Basic Empathy Scale. *Journal of Adolescence*, 29(4), 589-611.
<https://doi.org/10.1016/j.adolescence.2005.08.010>
- Kite, M. E., Deaux, K., & Haines, E. L. (2008). Gender stereotypes. In F. L. Denmark, & M. A. Paludi (Eds.), *Psychology of women: A handbook of issues and theories, 2nd ed.* (pp. 205-236). Praeger Publishers/Greenwood Publishing Group.
- Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). New York, NY : Guilford Press.
- Kuiper, R. M., & Ryan, O. (2018). Drawing conclusions from cross-lagged relationships: Re-Considering the role of the Time-Interval. *Structural Equation Modeling: A Multidisciplinary Journal*, 25(5), 809-823.
<https://doi.org/10.1080/10705511.2018.1431046>
- Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association*, 83(404), 1198-1202. <https://doi.org/10.1080/01621459.1988.10478722>
- Malti, T., Gummerum, M., Keller, M., & Buchmann, M. (2009). Children's moral motivation, sympathy, and prosocial behavior. *Child Development*, 80(2), 442-460. <https://doi.org/10.1111/j.1467-8624.2009.01271.x>

- Masten, C. L., Morelli, S. A., & Eisenberger, N. I. (2011). An fMRI investigation of empathy for 'social pain' and subsequent prosocial behavior. *NeuroImage*, *55*(1), 381-388. <https://doi.org/10.1016/j.neuroimage.2010.11.060>
- McDonald, K. L., Wang, J., Menzer, M. M., Rubin, K. H., & Booth-LaForce, C. (2011). Prosocial behavior moderates the effects of aggression on young adolescents' friendships. *International Journal of Developmental Science*, *5*(1-2), 127-137.
- Morelli, S. A., Ong, D. C., Makati, R., Jackson, M. O., & Zaki, J. (2017). Empathy and well-being correlate with centrality in different social networks. *Proceedings of the National Academy of Sciences of the United States of America*, *114*(37), 9843-9847. <https://doi.org/10.1073/pnas.1702155114>
- Mund, M., & Nestler, S. (2018). Beyond the Cross-Lagged Panel Model: Next-generation statistical tools for analyzing interdependencies across the life course. *Advances in Life Course Research*, 100249. <https://doi.org/https://doi.org/10.1016/j.alcr.2018.10.002>
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus. Statistical Analysis with Latent Variables: User's Guide* (8th ed.). Los Angeles: Muthén & Muthén.
- Orth, U., Clark, D. A., Donnellan, M. B., & Robins, R. W. (2021). Testing prospective effects in longitudinal research: Comparing seven competing cross-lagged models. *Journal of Personality and Social Psychology*, *120*(4), 1013-1034. <https://doi.org/10.1037/pspp0000358>
- Padilla-Walker, L. M., Dyer, J. W., Yorgason, J. B., Fraser, A. M., & Coyne, S. M. (2015). Adolescents' prosocial behavior toward family, friends, and strangers: A

person-centered approach. *Journal of Research on Adolescence*, 25(1), 135-150.
<https://doi.org/10.1111/jora.12102>

Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling and Psychology*, 57(1), 1-10. <https://doi.org/10.1037/a0018082>

Singer, T., & Lamm, C. (2009). The social neuroscience of empathy. *Annals of the New York Academy of Sciences*, 1156, 81-96. <https://doi.org/10.1111/j.1749-6632.2009.04418.x>

Siu, A. M. H., Shek, D. T. L., & Lai, F. H. Y. (2013). Predictors of prosocial behavior among Chinese high school students in Hong Kong. *International Journal of Child Health and Human Development*, 6(1), 103-111.

Steinberg, L., & Morris, A. S. (2001). Adolescent development. *Annual Review of Psychology*, 52, 83-110.

Stuijzand, S., De Wied, M., Kempes, M., Van de Graaff, J., Branje, S., & Meeus, W. (2016). Gender differences in empathic sadness towards persons of the same-versus other-sex during adolescence. *Sex Roles*, 75(9-10), 434-446.
<https://doi.org/10.1007/s11199-016-0649-3>

Van der Graaff, J., Branje, S., De Wied, M., Hawk, S., Van Lier, P., & Meeus, W. (2014). Perspective taking and empathic concern in adolescence: Gender differences in developmental changes. *Developmental Psychology*, 50(3), 881-888. <https://doi.org/10.1037/a0034325>

Van der Graaff, J., Carlo, G., Crocetti, E., Koot, H. M., & Branje, S. (2017). Prosocial behavior in adolescence: Gender differences in development and links with

empathy. *Journal of Youth and Adolescence*, 1-14.

<https://doi.org/10.1007/s10964-017-0786-1>

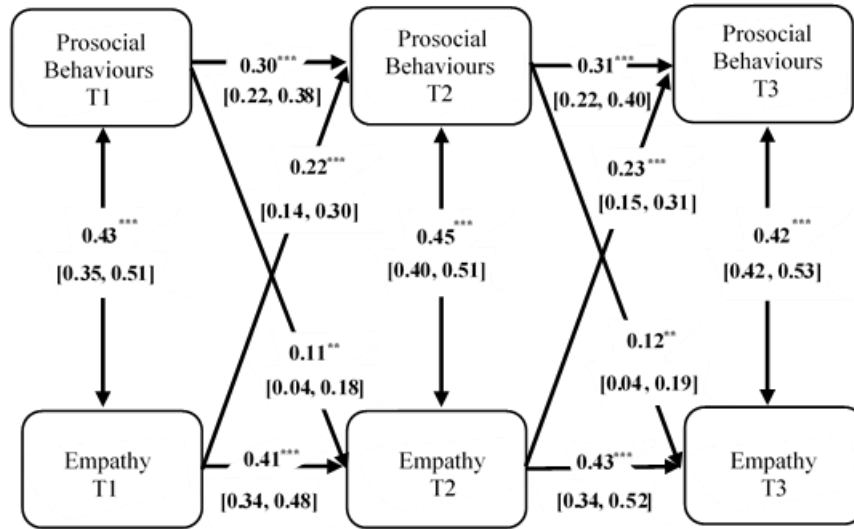
Zhou, N., Cao, H., Liu, F., Wu, L., Liang, Y., Xu, J., Meng, H., Zang, N., Hao, R., An, Y., Ma, S., Fang, X., & Zhang, J. (2020). A four-wave, cross-lagged model of problematic internet use and mental health among Chinese college students: Disaggregation of within-person and between-person effects. *Developmental Psychology*, 56(5), 1009-1021. <https://doi.org/10.1037/dev0000907>

Zuffianò, A., Eisenberg, N., Alessandri, G., Luengo Kanacri, B. P., Pastorelli, C., Milioni, M., Caprara, G. V., & Zuffianò, A. (2016). The relation of pro-sociality to self-esteem: The mediational role of quality of friendships. *Journal of Personality*, 84(1), 59-70. <https://doi.org/10.1111/jopy.12137>

DISENTANGLING BETWEEN- AND WITHIN-PERSON ASSOCIATIONS

Figure 1

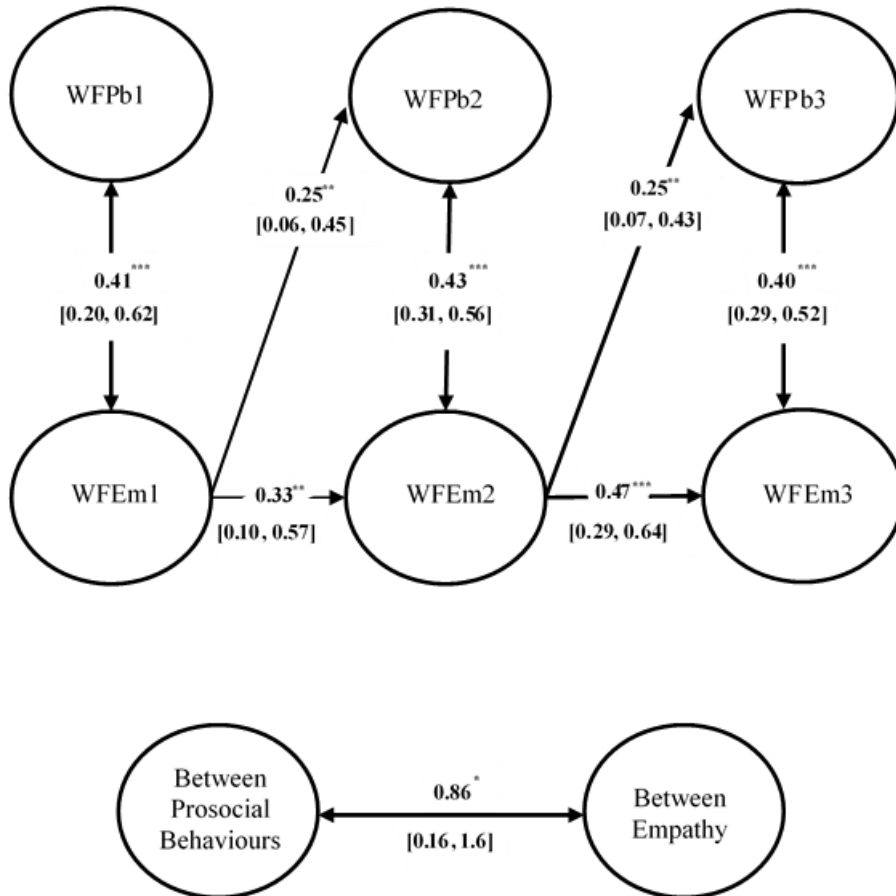
Cross-lagged panel model with standardized coefficients



Note. Numbers between brackets indicate the 95% confidence interval. ** $p < .01$; *** $p < .001$.

Figure 2

Simplified Random Intercept Cross-lagged panel model with standardized coefficients



Note. WFPb1-3= Within-factor prosocial behaviours T1-T3. WFEm1-3 = Within-factor empathy T1-T3. All possible cross-lag paths were estimated, but only significant paths are shown. Numbers between brackets indicate the 95 % confidence interval.

*p < .05, **p < .01; ***p < .001.

DISENTANGLING BETWEEN- AND WITHIN-PERSON ASSOCIATIONS

Table 1

Descriptive statistics and Correlation coefficients between prosocial behaviours and empathy

Variable	Total	Males	Females	6th Grade	7th Grade	ωs	1	2	3	4	5	6
	(N=383)	(n=193)	(n=190)	(n=212)	(n=171)							
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)							
1. Prosocial behaviours (Time 1)	3.75 (.63)	3.51 (.40)	3.99 (.29)	3.79 (.42)	3.74 (.36)	.75	-	.408	.310	.489	.301	.213
2. Prosocial behaviours (Time 2)	3.71 (.68)	3.49 (.53)	3.93 (.29)	3.69 (.40)	3.72 (.55)	.77		-	.441	.445	.545	.367
3. Prosocial behaviours (Time 3)	3.77 (.70)	3.55 (.46)	3.99 (.36)	3.83 (.39)	3.69 (.60)	.80			-	.243	.328	.509
4. Empathy (Time 1)	3.78 (.59)	3.52 (.35)	4.05 (.23)	3.81 (.39)	3.80 (.31)	.67				-	.448	.273
5. Empathy (Time 2)	3.70 (.62)	3.46 (.34)	3.93 (.33)	3.70 (.34)	3.68 (.44)	.69					-	.525
6. Empathy (Time 3)	3.62 (.66)	3.38 (.34)	3.90 (.39)	3.69 (.43)	3.58 (.43)	.69						-

Note. ωs = omega coefficient. All correlations are significant at $p < .001$.

DISENTANGLING BETWEEN- AND WITHIN-PERSON ASSOCIATIONS

Table 2

Parameter Estimates Obtained in Constrained Cross-Lagged Panel Models and Constrained Random Intercept Cross-Lagged Panel Models Linking Adolescent Empathy and Adolescent Prosocial behaviours

Parameter	Standard Cross-Lagged Panel Model					Random Intercept Cross-Lagged Panel Model				
	B	SE	p_B	CI	β	B	SE	p_B	CI	β
<i>Associations</i>										
Between-person association						.057	.044	.016	.16 to 1.5	.861
T1 association	.154	.017	.000	.35 to .51	.431	.125	.055	.017	.20 to .62	.413
<i>Cross-lagged effects</i>										
Empathy 1 → Prosocial Behaviours 2	.256	.045	.000	.14 to .30	.220	.261	.094	.006	.06 to .45	.254
Empathy 2 → Prosocial Behaviours 3	.256	.045	.000	.15 to .31	.226	.261	.094	.006	.07 to .43	.249
Prosocial Behaviours 1 → Empathy 2	.112	.039	.004	.04 to .18	.109	.069	.073	.344	-.07 to .20	.063
Prosocial Behaviours 2 → Empathy 3	.112	.039	.004	.04 to .19	.115	.069	.073	.344	-.07 to .19	.062
<i>Stability paths</i>										
Prosocial Behaviours 1 → Prosocial Behaviours 2	.330	.047	.000	.22 to .38	.300	.115	.100	.248	-.07 to .28	.106
Prosocial Behaviours 2 → Prosocial Behaviours 3	.330	.047	.000	.22 to .40	.310	.115	.100	.248	-.08 to .30	.109
Empathy 1 → Empathy 2	.450	.044	.000	.34 to .48	.412	.348	.119	.003	.10 to .57	.334
Empathy 2 → Empathy 3	.450	.044	.000	.34 to .52	.431	.510	.098	.000	.29 to .64	.465
<i>Correlated change</i>										
T2	.154	.017	.000	.40 to .51	.451	.131	.024	.000	.31 to .56	.434
T3	.154	.017	.000	.42 to .53	.424	.131	.024	.000	.29 to .52	.402

DISENTANGLING BETWEEN- AND WITHIN-PERSON ASSOCIATIONS

Note. Cross-lagged panel model (Figure 1), Random Intercept Cross-Lagged Panel Model (Figure 2). CI = 95% Confidence Interval. Standardized effects (β) are indicators of effect size. $N = 383$, measurements = 3. The substantial interpretation of correlations, cross-lagged effects and correlated change is different in both models. In a standard cross-lagged panel model, parameters reflect how an individual's relative position compared to the rest of the samples are correlated or can be predicted, which aggregates within- and between person sources of variation. In a Random Intercept Cross-Lagged Panel Model, parameters reflect how within-person variations relative to their own scores are correlated or can be predicted.