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Longitudinal Associations Between Prosocial Behavior and Behavioral Problems Across Childhood: A Robust Random-Intercept Cross-Lagged Panel Model

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Prior studies have indicated that prosocial behavior might be a protective factor for developing internalizing and externalizing behavioral problems. However, little research has been conducted on within-person changes of prosocial behavior and behavioral problems over time. With random-intercept cross-lagged panel models (RI-CLPMs), the current study analyzed longitudinal associations between prosocial behavior and behavioral problems in two twin cohorts (98% Western European): in early childhood (age $M = 4.77$, $SD = .58$, 52% girls, $N = 440$) and middle childhood (age $M = 7.94$, $SD = .67$, 51% girls, $N = 512$). To obtain robust results, two parental reported questionnaires and an observational task were used as prosocial behavior assessments. In line with the literature, we found a significant between-person association between externalizing behavior and parent reported prosocial behavior in middle childhood, but not in early childhood. Some evidence indicated that changes in externalizing problems affect later prosocial behavior in middle childhood. Overall, however, the RI-CLPMs provided most support for the hypothesis that within-person changes in prosocial behavior are not related to within-person changes in behavioral problems. Thus, our findings did not support the hypothesis that increased prosocial behavior directly results in decreased behavioral problems, but emphasizes the need to take into account the multifaceted nature of prosocial behavior.

Keywords: prosocial behavior, externalizing behavior, internalizing behavior, longitudinal development, random intercept cross lagged panel models

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A broad range of studies has shown that prosocial behavior and behavioral problems are related constructs (Memmott-Elison et al., 2020). Children and adolescents higher in prosocial behavior—defined as voluntary acts intended to benefit another individual (Eisenberg et al., 2007)—are often reported to be lower in behavioral problems such as externalizing and internalizing problems (Flynn et al., 2015; Memmott-Elison et al., 2020). These studies suggest that prosocial behavior might be a protective factor for developing behavioral problems and therefore several researchers have proposed that prosocial behavior could be an interesting target in interventions for lowering behavioral problems. This idea implies a directional effect from prosocial behavior to behavioral problems within the

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Data, study material, and analysis scripts are available at DataverseNL through https://doi.org/10.34894/G3VTQJ.

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developing child. However, little research has been done on *within-person changes* of prosocial behavior and behavioral problems over time (Padilla-Walker et al., 2015; Padilla-Walker et al., 2018). That is, if a child becomes more prosocial across time, does this lead to a decrease in their behavioral problems and vice versa? In the current study, we used random-intercept cross-lagged panel models (RI-CLPM; Hamaker et al., 2015) to investigate the within-person associations between prosocial behavior and behavioral problems during early and middle childhood (see Figure 1). In addition, we aimed to test for sensitive periods by investigating *during which developmental phase* these within-person associations would be strongest.

Prosocial Behavior in Childhood

Prosocial behavior is a key component in the formation of positive and stable social relationships (Over, 2016; Steinbeis et al., 2012). As positive social relationships contribute to overall better well-being and decreased experiences of stress (Eisenberg et al., 2015), prosocial behavior is often seen as an important factor for positive development of children. Childhood is an important period of transition in the content and context of social relationships. For example, friendships in early childhood (3–6 years) are often facilitated by parents or caretakers (by providing opportunities to play together; Howes, 2009). In contrast, long-lasting friendships in middle childhood (7–12 years) are often based on shared interests and are formed with little parental involvement (del Giudice et al., 2009; Gifford-Smith & Brownell, 2003). This development in social relationships goes hand in hand with increases in prosocial behavior. Children as young as 18 months already show prosocial behavior by helping others (Warneken & Tomasello, 2006). Their affective (that is, empathy; Eisenberg et al., 2015) and cognitive (that is, perspective-taking; Penner & Finkelstein, 1998) abilities increase with age, and result in more prosocial choices to share and give to others in adolescence (Guroglu et al., 2014).

Studies employing multi-informant reports of prosocial behavior have suggested prosocial behavior to be a relatively stable trait within individuals (Eisenberg et al., 2002, Eisenberg, et al., 2014; Flynn et al., 2015; Nantel-Vivier et al., 2009) such that children who exhibit more prosocial behavior in early childhood also appear to be relatively more prosocial later in life, but empirical findings are more mixed. That is, studies reported both increases and decreases in prosocial donating behavior, depending on context and recipient (Crone & Achterberg, 2021; van IJzendoorn & Bakermans-Kranenburg, 2014; van IJzendoorn et al., 2010). These findings reflect one of the main challenges in investigating prosocial behavior: The construct is used as an umbrella-term for various behaviors, including sharing resources, cooperating, helping someone in distress, and comforting (Eisenberg et al., 2007). These various types of prosocial behavior show different developmental trajectories (for a review see Padilla-Walker et al., 2018) and the best method for measuring prosocial behavior is strongly debated (El Mallah, 2020). In the current study we therefore employ both parent report and behavioral observation to assess prosocial behavior. It should be noted that across studies however, between- and within-individual differences in prosocial behavior are prominent across the life span (Eisenberg et al., 1999) and have been related to several developmental outcomes.

Between-Person Effects of Prosocial Behavior and Behavioral Problems

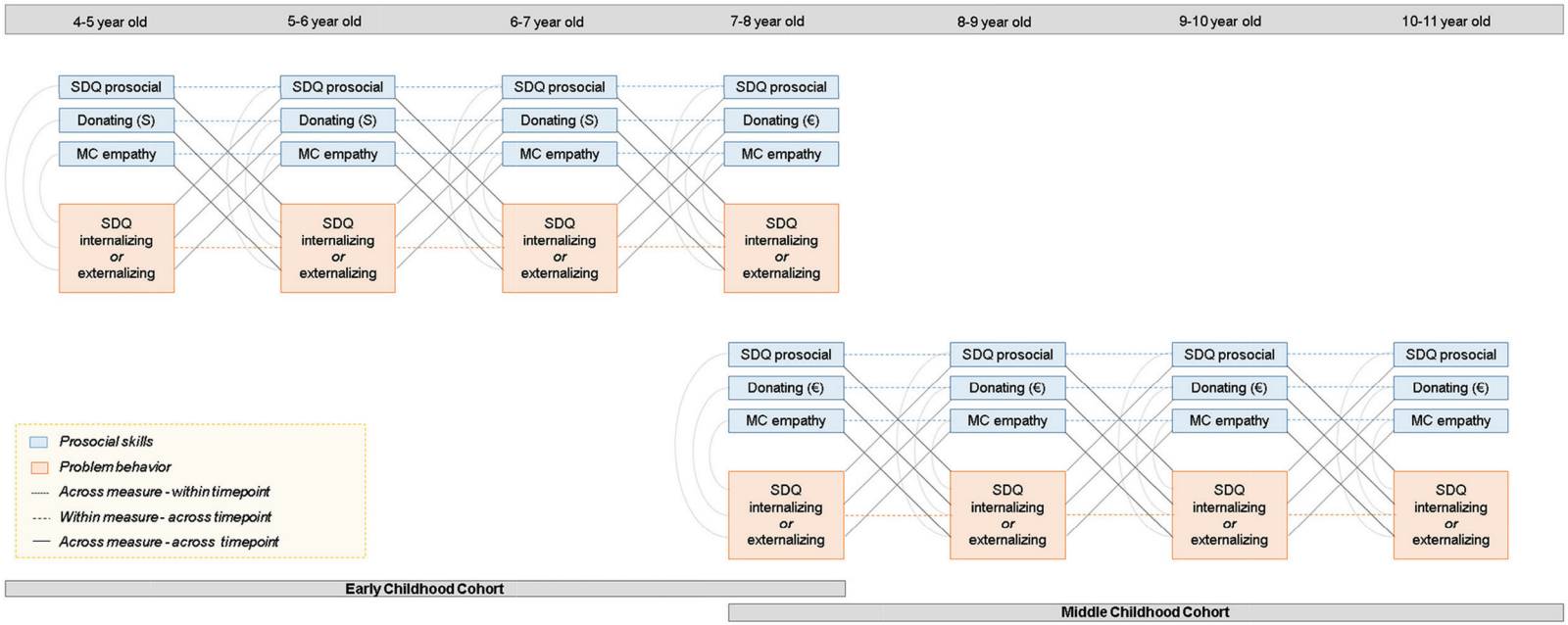
For example, prosocial behavior has been found to be negatively related to behavioral problems (Memmott-Elison et al., 2020). Behavioral problems are often categorized in internalizing behaviors (for example, anxiety, depression) and externalizing behaviors (for example, aggression, delinquency). Previous studies reported that prosocial behavior is related to decreases in internalizing problems, although in general the effects are small and complex (Flynn et al., 2015; Huber et al., 2019; Nantel-Vivier et al., 2009). For example, high prosocial trajectories can co-occur with both low and high anxiety trajectories (Nantel-Vivier et al., 2009). Possibly, for some children showing prosocial behavior might be associated with an overconcern or worry for others (Hay & Pawlby, 2003), which could lead to internalizing problems. On the other hand, showing prosocial behavior could also result in positive self-views and peer interaction (Fu et al., 2017; Wang et al., 2019), thereby reducing risk for anxiety and depression (Lee & Stone, 2012; Ybrandt, 2008). Indeed, recent meta-analysis results overall revealed a negative relation between prosocial behavior and internalizing problems (Memmott-Elison et al., 2020). The association between prosocial behavior and externalizing problems seems to be more pronounced: Children and adolescents who score high on externalizing problems generally show less prosocial behavior (Flouri & Sarmadi, 2016; Memmott-Elison et al., 2020; Nantel-Vivier et al., 2009). Possibly, a lack of behavioral regulation results in both externalizing problems and an inability to show prosocial behavior (Memmott-Elison et al., 2020). Additionally, it has been proposed that regular engagement in prosocial behavior could alter behavioral patterns and behaviors, such that children are encouraged to continue showing prosocial behavior and become resilient to problematic outcomes (Masten, 2001; Masten & Cicchetti, 2010). However, these results are based on between-person effects and are not informative on the relation between those variables within a person. Thus, although between-person studies suggest that children high on prosocial behavior often display less problem behavior, the literature is less clear on whether a within-person increase of prosocial behavior is related to a within-person decrease of problem behavior. However, to achieve (causal) behavioral change, it is precisely this within-person association that is necessary for successful interventions.

Within-Person Effects of Prosocial Behavior and Behavioral Problems

The few studies that did investigate within-person change in the relation between prosocial behavior and behavioral problems mainly focused on the period of adolescence (Padilla-Walker et al., 2015, 2018). For instance, Padilla-Walker et al. (2018) showed that prosocial behavior and aggression were negatively associated bidirectionally over time in 12- to 18-year-old adolescents, suggesting that within-person increases in prosocial behavior result in within-person decreases in aggression. However, it might be important to investigate within-person changes in an earlier phase, during childhood, because it is unclear whether these within-person effects of prosocial behavior and externalizing and internalizing problems also occur in childhood. This is a crucial question with respect to intervention planning, as it is often suggested that early interventions (that is, during early childhood) result in the largest effects. However, one might suggest that middle childhood is a more

Figure 1

Random Intercept Cross-Lagged Panel Model (RI-CLPM) to Test for Within-Person Longitudinal Associations Between Prosocial Behavior and Behavioral Problems Across Childhood



Note. See the online article for the color version of this figure.

suitable period for such within-person changes, as this is a developmental phase where the first friendships emerge and prosocial behavior becomes specifically important (Gifford-Smith & Brownell, 2003; van der Meulen et al., 2018). Therefore, after describing average developmental trends, the current study aimed to investigate (a) the within-person relations between prosocial behavior and behavioral problems and (b) whether the effects are stronger in 4- to 8-year-old children as compared with 7- to 11-year-olds (i.e., are there sensitive periods?). The study made use of data from the longitudinal cohort-sequential twin study of the Leiden Consortium on Individual Development (L-CID; Crone et al., 2020; Euser et al., 2016).

The Present Study

We investigated the relations between prosocial behavior and behavioral problems by means of a random-intercept cross-lagged panel model (RI-CLPM; Hamaker et al., 2015) for the early and middle childhood cohort separately. The RI-CLPM takes a multilevel approach: It separates stable between-person differences from within-person variance. In this manner, reciprocal relations between variables within a person can be captured. We tested how prosocial behavior relates to both internalizing and externalizing behavioral problems as reported by the parent.

As prosocial behavior has been shown to vary across contexts and recipients (El Mallah, 2020) we used three indicators of prosocial behavior to examine the robustness of our results: parental report of prosocial behavior (SDQ; van Widenfelt et al., 2003); parental report of empathic and prosocial response to another's distress (MyChild Questionnaire; Kochanska et al., 1994); and costly donating behavior by the child (behavioral task). Parent-report measures of prosocial behavior and empathy are particularly valuable in childhood, as reporting on these socially complex behaviors is often challenging for children (Richaud et al., 2017) and parent-reports usually encompass multiple contexts (Carlo & Randall, 2002). However, as parent-reports often suffer from positive bias, we also included observed prosocial behavior using a costly donating task (Knafo et al., 2011; Thijssen et al., 2015; van IJzendoorn et al., 2010; Wildeboer et al., 2018). If all three measures demonstrate the same effects, we can be confident that the finding is robust. If effects are only found in one or more specific measures, we can interpret the different findings taking into account the different measures.

Instead of bivariate models, we thus ran multivariate RI-CLPMs with four variables: three measures of prosocial behavior in relation to one measure of behavioral problems. To be able to draw robust overall conclusions, we aggregated the evidence by computing Bayes factors for competing informative hypotheses (Hoijtink, 2012). These informative hypotheses reflect competing theories with respect to the model parameters. For example, a bidirectional effect would be reflected by a hypothesis in which the cross-lagged parameters in both directions are negative. The aggregative component in these hypotheses is that the pattern is specified for each measurement method in the model. Thus, within one hypothesis the bidirectional effect is specified for the SDQ in relation to internalizing problems, MyChild in relation to internalizing problems, and the donating task in relation to internalizing problems.

As Bayes factors express the evidence relative to other hypotheses, a set of competing informative hypotheses has to be constructed. Based on earlier studies like Flynn et al. (2015), we expected that increased prosocial behavior relates to later diminished behavioral problems, and vice versa (i.e., H3 in Table 1). However, previous research investigated between-person differences instead of within-person effects; hence, we could still find that there is no effect from one (H1 and H2) or both of the constructs (H0). As is common when composing a set of informative hypotheses (Hoijtink, 2012), we also included an alternative (fail-safe) hypothesis that would get most support in case the parameter estimates are different from our expectations in H0–H3 (see Table 1), for example, due to mixed results. To explore possible sensitive windows, we compared the early childhood and middle childhood standardized cross-lagged loadings from prosocial behavior with behavioral problems. Because both periods have been suggested to be important for within-person changes, we did not have specific hypotheses on the direction of this effect.

Method

Participants

Participants in this study took part in the longitudinal cohort-sequential twin study of the L-CID (Crone et al., 2020; Euser et al., 2016). Invitations to participate were sent to families with same-sex twins born between 2010 and 2013 (early childhood) and born between 2006 and 2009 (middle childhood) living within 2 hr travel time from Leiden. For each family both children participated in the study. The majority of the sample was Caucasian (ECC: 96%, MCC: 91%) and right-handed (ECC: 86%, MCC:87%). Because the sample represents a population sample, we did not exclude children with a psychiatric disorder. Social economic status (SES), based on parental education, was middle-to-high (for details, see Table 2; Crone et al., 2020). Participants were fluent in Dutch and were excluded when they had visual or physical impairments that could disable them from performing the behavioral tasks.

The procedures were approved by the Dutch Central Committee for Human Research (CCMO, study name: "Brain Development in Childhood and Emerging Adolescence," protocol: NL50277.058.14) and written informed consent was obtained from both parents.

The data were collected during annual visits in two cohorts: The Early Childhood Cohort (ECC; starting with 3- to 4-year-olds) and the Middle Childhood Cohort (MCC; starting with 7- to 8-year-olds). Between the second and third time point of the L-CID study, approximately 40% of the parents of the L-CID study received a video-feedback intervention to promote positive parenting and sensitive discipline (VIPP-TWINS; Euser et al., 2016). The other 60% of the parents received a control condition consisting of phone calls. The VIPP-SD has been related to decreases in problem behavior (e.g. O'Farrelly et al., 2021) and might be related to increases in social competence, such as prosocial behavior (see Euser et al., 2016). Because the VIPP-SD intervention was not the emphasis of the current study, but could potentially influence the results, we controlled all analyses for intervention group by adding a dummy variable (0 = intervention group, 1 = control group). For details regarding the L-CID study and procedure see Crone et al. (2020). At the first wave of data collection 988 children were included in the L-CID study (ECC: $N = 476$, MCC: $N = 512$). The

Table 1
Competing Informative Hypotheses of the Random-Intercept Cross Lagged Panel Model

H0: The cross-lagged relations are all equal to zero (i.e., no effects)
H1: There is a negative within-person cross-lagged relation from prosocial behavior to behavioral problems, but not the other way around
H2: There is a negative within-person cross-lagged relation from behavioral problems to prosocial behavior, but not the other way around
H3: There is a negative within-person cross-lagged relation from prosocial behavior to behavioral problems and from behavioral problems to prosocial behavior
Ha: Anything else

majority of the sample was Caucasian (ECC: 96%, MCC: 91%) and had normal IQ (ECC: 102.89 +/− 10.75; MCC: 103.58 +/− 11.76).

Annual visits were either a home visit, in which families performed behavioral tasks at home, or a lab visit, in which families were invited to participate in an EEG or MRI session. So far, five waves were completed in the ECC (W1: N = 476, W2: N = 428, W3: N = 400, W4: N = 396, W5: N = 360). Families in the MCC have participated in four annual visits (W1: N = 512, W2: N = 494, W3: N = 456, W4: N = 402). For the current study, we made use of ECC Waves 2–5 (corresponding to an age range of 4–8, N = 440, age at W2: 4.77 ± .58 years, 52% girls) and MCC Waves 1–4 (age range 7–11; N = 512, age at W1: 7.94 ± .67, 51% girls). As preregistered, we chose not to include the first time point of the ECC because one of the indicators of prosocial behavior (MyChild empathic and prosocial response subscale) was not included in this visit (see Appendix I of Crone et al., 2020). That is, for the current study we used the ECC data from W2 as T1, W3 as T2, W4 as T3, and W5 as T4. For the MCC the data of waves corresponds to our time points (W1 = T1, W2 = T2, W3 = T3, W4 = T4). Table 2 provides an overview of the demographic characteristics of the sample at the first included time point.

Procedure

Questionnaires (see online supplementary material) were filled in by the primary parent, which was defined as the parent that spent the most time with the children at the start of the L-CID study. The majority of the primary parents was female (ECC: 92%, MCC: 91%). Questionnaire data was obtained through online questionnaires distributed via Qualtrics in the 2 weeks prior to the annual visit or during the annual visit. The behavioral donating task was conducted during the visits, either at home (ECC T1, T4; MCC T2, T4) or at the university (ECC T2, T3; MCC T1, T3).

Table 2
Demographic Characteristics of the Early Childhood Cohort (ECC) and Middle Childhood Cohort (MCC) at the First Included Timepoint

Descriptive	ECC	MCC
N	428	512
Mean age at T1 (*SD*)	4.77 (0.58)	7.94 (0.67)
Age range at T1	3.86−6.54	7.02−9.68
Girls	52%	51%
Monozygotic	57%	55%
SES low – middle – high	7% − 37% − 56%	9% − 46% − 45%

Note. SES = socioeconomic status based on parental education.

The same materials (laptops, piggy banks) were used for home and lab visits.

Measures of Prosocial Behavior

For all measures described below, latent factor analyses with effects-coding identification (Little et al., 2006) were conducted and measurement invariance over time was evaluated. As factor loadings may differ between the items in a scale, we calculated reliability with McDonald's ω (McDonald, 1970; McNeish, 2018). Depending on the model fit, the latent factor scores of the metric or scalar model were saved and used in all further analyses.

SDQ Prosocial Behavior

To measure prosocial behavior, we used the parent-report version of the Strengths and Difficulties Questionnaire (SDQ; van Widenfelt et al., 2003). The SDQ is widely used to measure psychosocial functioning in children aged 2–17 years. It consists of five subscales (i.e., emotional problems, peer problems, hyperactivity, conduct problems, and prosocial behavior) of five items each. Each item was answered on a 3-point Likert scale, ranging from *not true* to *certainly true*. The prosocial behavior subscale consists of items such as "My child *is considerate of other people's feelings*." The internal consistency of the Dutch version of this subscale has been found to be good (α = .71 in 4- to 5-year-olds, α = .74 in 6- to 11-year-olds; Maurice-Stam et al., 2018). In the current study we found that McDonald's ω > .66 for the SDQ prosocial factor at T1–T4 in ECC and T1–T2 and T4 in MCC. At T3 in MCC McDonald's ω = .59 (see Supplementary Table S1 for all estimates).

MyChild Empathic and Prosocial Response

Additionally, we assessed prosocial behavior with the parent-report of the empathic and prosocial response to another's distress subscale of the MyChild Questionnaire (Kochanska et al., 1994). This subscale contains 13 items (e.g., "*My child will try to comfort or reassure another in distress*") which can be answered on a 5-point Likert scale, ranging from *not true* to *true*. The item "*My child teases pets when no-one is watching*" had a standardized loading < .01 in the ECC and .11 in the MCC, and was therefore excluded in both the ECC and MCC. Additionally, the item "*My child is sweet and caring for animals"* (standardized loading <.30 in W2–W4) was excluded in the ECC. In the current study we found that McDonald's ω > .72 for the MyChild empathic and prosocial response factor at T1–T4 in ECC and T1-T4 in MCC (see Supplementary Table S1 for all estimates), similarly to what has been previously reported (α = .76 in 1- to 6-year-olds; Kochanska et al., 1994).

Donating Task

Costly prosocial behavior was measured with an age-appropriate costly donating task: For children aged 4–7 (ECC T1-T3) we used a version with stickers and for children aged 7–11 (ECC T4; MCC T1-T4) we used a donating task with money. After each wave of data collection, the total amount of money donated by the children was transferred to the charity.

Stickers for Peers. Prior to the donating task, the participating child received 10 stickers for their effort during the data collection. The child was allowed to keep those stickers. Costly prosocial behavior was measured by the donating task (Knafo et al., 2011; Thijssen et al., 2015; Wildeboer et al., 2018) in which the child was told that another same-sex child would participate in the research tomorrow. This other child would complete the same tasks, but they would not have any stickers. The participating child was instructed as follows: "You can give some of your stickers to the child that will participate tomorrow." The child was then handed an envelope. "If you want to give some stickers to the boy/girl that doesn't have any stickers, you can put them in this envelope. We will give the stickers to the boy/girl. If you want to keep all stickers for yourself, you can give me the empty envelope. You can decide whether and how many stickers you want to give to the boy/girl." Following this instruction, the child was left alone for 1 min. After 1 min the researcher returned and asked whether the child was done dividing the stickers and the donating task was concluded. After the visit donating behavior was measured by the number of stickers the child had put in the envelope.

Money for Charity. Prior to the donating task, the children received a small amount of money for their effort during the data collection. The child was allowed to keep the money. Costly prosocial behavior was measured by the donating task in which children were shown a short video from a charity organization on a computer (Pannebakker, 2007; Wildeboer et al., 2017). The amount of money was adapted in line with the participant's age (2 euros in 20 coins of €.10 for ECC T4; MCC T1, T2, T3; and 4 euros in 20 coins of €.20 for MCC T4). Different charities were chosen for different waves (ECC T4: UNICEF; MCC T1: UNICEF, T2: SOS Child Villages, T3: Liliane foundation, T4: UNICEF). This was done in order to control for learning effects. The video featured the life of a poor, malnourished child in a developing country, followed by some information on what the charity would do to help children in that situation. After the video (50 s), participants were shown a message on the screen for 12 s that stated: "Do you want to give something to these children to help them eat? The money from the piggy bank goes to charity. Even small donations help!" The message was also read out loud. Following this, participants were shown another slide for 9 s that stated: "If you want to give money, you can put it in the piggy bank" (see Figure 2). Donating behavior was measured by the amount of money the child had put in the piggybank.

Half of all participants received a different condition of the video: They were shown the exact same video, with one alternation. After the slide that explained where the donations would go, participants were shown a short 13 s video of a same-sex peer donating money to the charity organization, as a probe for donating (see Figure 2). The two conditions were included in the study in order to see if children would have different reactions to different nudges. Previous studies have suggested that children who are probed by the experimenter to donate money to charity are more likely to donate than those children who are not probed (van IJzendoorn et al., 2010; Wildeboer et al., 2017). Whether children received the short or long version was randomly decided per family and could be different across different time points. Independent *t*-tests per time point showed no significant effect of video condition on donated money (all *p*-values $>.144$). Therefore, we did not further include the donating condition as a time-varying covariate.

Measures of Behavioral Problems

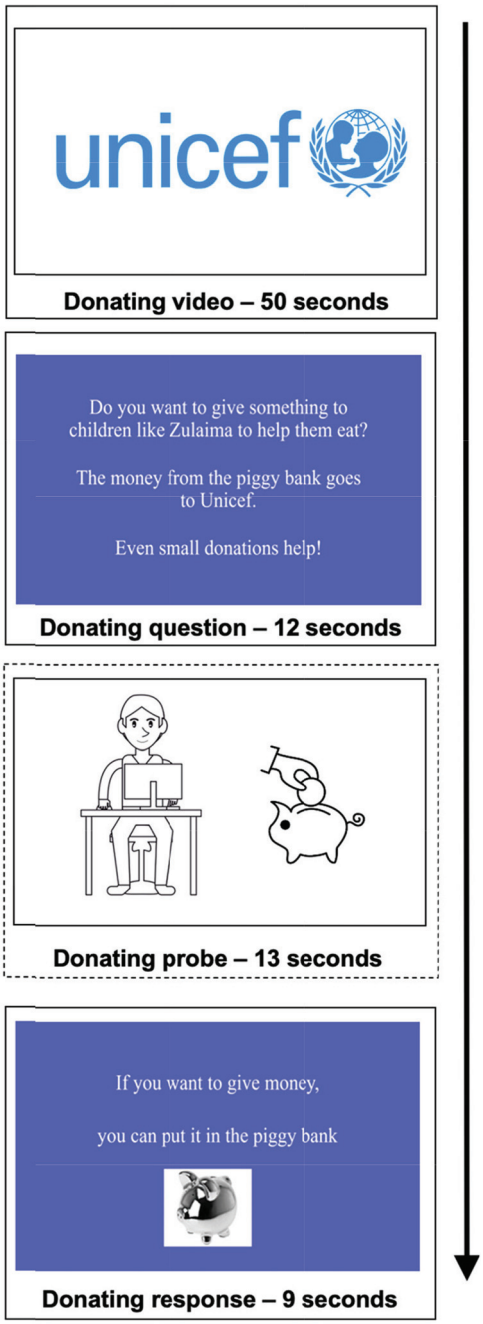
To measure internalizing and externalizing behavioral problems, the parent-report version of the SDQ was used (R. Goodman, 1997). Both scale-scores were composed of multiple subscales as evaluated and suggested by (Goodman et al., 2010). The internalizing problems scale included the items of the emotional problems (e.g., "My child *has many fears, is easily scared*") and peer problems (e.g., "My child *gets on better with adults than with other children*") scales. As the item "My child *has at least one good friend*" had a standardized loading $<.30$ in ECC T1, T2 and T4 this item was not included in the peer problems subscale for ECC. To calculate an externalizing problems scale, the subscales hyperactivity (e.g., "My child *is restless, overactive, cannot sit still for long*") and conduct problems (e.g., "My child *often lies or cheats*") were combined. The internal consistency of the Dutch version of both subscales has been found to be moderate to good (internalizing: $\alpha = .67$ in 4- to 5-year-olds, $\alpha = .80$ in 6- to 11-year-olds; externalizing: $\alpha = .76$ in 4- to 5-year-olds, $\alpha = .80$ in 6- to 11-year-olds; Maurice-Stam et al., 2018). In the current study we found that McDonald's $\omega > .68$ for the internalizing problems and externalizing problems factors at all time points in both ECC and MCC (see Supplementary Table S1 for all estimates).

Statistical Analyses

First, we describe average developmental trends (i.e., at the between level) by means of latent growth curve models executed with *lavaan* (Rosseel, 2012) in R (R Core Team, 2019). An intercept only, linear, and quadratic growth curve model were fitted for each prosocial skill and behavioral problems variable separately. The best fitting model was selected based on the lowest Bayesian Information Criterion value. The results of the preferred model are presented in more detail.

Next, to investigate the bidirectional within-person relations between prosocial behavior and behavioral problems, we ran multivariate RI-CLPMs (Hamaker et al., 2015) in the R-package *lavaan*. The RI-CLPMs, which were evaluated for the ECC and MCC separately, each included three measures of prosocial behavior and one for either internalizing or externalizing behavioral problems. Figure 1 depicts a simplification of the model, where the stable horizontal lines are the autoregressive paths, the diagonal lines are the cross-lagged paths, and the curved lines reflect the within-time (residual) correlations. Autoregressive paths reflect the within-person stability (i.e., carry-over effects). Cross-lagged effects denote to what extent a previous deviation (from a person-specific mean) in one variable is associated with a subsequent deviation in the other variable. The within-time correlations reflect to what extent deviations from the person-specific mean in one variable are accompanied by deviations from the person-specific mean in the

Figure 2
Costly (Money) Donating Task



Note. Children viewed a charity video of 50 s (different videos for different time points) followed by a donating question which was also read out loud. Then participants viewed a screen that indicated they could donate money if they wanted to. Half of the sample viewed a donating probe were a same-sex peer (here visualized by a pictogram) donated money to the charity (long condition), depicted in the dashed frame. See the online article for the color version of this figure.

other variable. To separate these associations at the within-person level from the between-person level, overall random intercepts are introduced in the model. The random intercepts capture stable between-person differences on a variable. Correlations between random intercepts reflect to what extent stable differences between persons in two concepts are correlated.

To aggregate the results over the three measures of prosocial behavior, we calculated Bayes factors and posterior model probabilities over a set of informative hypotheses (Hoijtink, 2012) concerning the parameters in relation to all three measures of prosocial behavior by means of the R-package *bain* (Gu et al., 2018). The set of informative hypotheses was based on previous research findings, as explained in the Introduction section.

To investigate possible sensitive windows, we compared the early childhood and middle childhood standardized cross-lagged loadings from prosocial behavior to behavioral problems. A stronger negative path might indicate a better opportunity to promote prosocial behavior in order to decrease behavioral problems.

In all analyses missing data were handled by means of full information maximum likelihood estimation (FIML) and we accounted for the twins by applying a cluster correction in *lavaan* with the family ID variable. Materials, data, and analysis scripts are available at DataverseNL.

Results

Group Level Developmental Trends

First, we investigated developmental trends (on a group level) of the three prosocial variables (SDQ prosocial behavior, MyChild empathic and prosocial response, and donating behavior) and the two behavioral problems variables (internalizing and externalizing).The quadratic model was the preferred growth model for all variables, except for donating behavior in the ECC where the null model was preferred. Model fit statistics for the selected models were good and are provided Supplementary Table S2. The parameter estimates for the linear and quadratic slope factor intercepts and variances are given in Table 3. The average scores over time for each variable and both cohorts are shown in Figure 3.

Prosocial Development on Average

For SDQ prosocial behavior, only the quadratic slope factor was significantly different from 0, indicating a delayed increase in prosocial behavior in the ECC (see Figure 3a). The quadratic slope also significantly varied between persons, suggesting variability. In the MCC, participants followed a pattern of delayed increase on average (see Figure 3a), but there was significant variability.

For MyChild empathic and prosocial response, the linear and quadratic slope indicated a decelerating increase in both groups (see Figure 3b). Except for the linear slope variance in the MCC, the between-person variance for the intercept, linear and quadratic growth factors were also significant.

With respect to donating behavior, the null model was selected in the ECC, indicating stability of the sample mean (see Figure 3c). In the MCC, both the linear and quadratic slope were significant, as well as the variance of the linear slope. On average, donating behavior followed a pattern of decelerating increase in the MCC (see Figure 3c).

Table 3
Latent Growth Model Factor Means and Variances for Prosocial Behavior and Behavioral Development

		Growth factor							
		Linear slope				Quadratic slope			
		μ		σ^2		μ		σ^2	
Variable	Cohort	*M* (*SE*)	*p*-value	*M* (*SE*)	*p*-value	*M* (*SE*)	*p*-value	*M* (*SE*)	*p*-value
SDQ prosocial	ECC	−0.01 (0.01)	.216	0.00 (0.00)	.635	0.01 (0.00)	<.001	0.00 (0.00)	<.001
	MCC	−0.03 (0.01)	<.001	0.03 (0.00)	<.001	0.02 (0.00)	<.001	0.00 (0.00)	<.001
MyChild empathic and prosocial response	ECC	0.24 (0.02)	<.001	0.07 (0.02)	<.001	−0.06 (0.00)	<.001	0.00 (0.00)	.001
	MCC	0.16 (0.02)	<.001	−0.01 (0.02)	.497	−0.05 (0.00)	<.001	0.00 (0.00)	<.001
Prosocial donating	ECC	—	—	—	—	—		—	—
	MCC	0.13 (0.02)	<.001	0.06 (0.02)	.003	−0.03 (0.01)	<.001	0.00 (0.00)	.393
Internalizing problems	ECC	0.02 (0.01)	.285	−0.04 (0.02)	.041	0.00 (0.00)	.756	0.00 (0.00)	.927
	MCC	0.09 (0.01)	<.001	−0.00 (0.01)	.913	−0.03 (0.00)	<.001	0.00 (0.00)	.010
Externalizing problems	ECC	−0.06 (0.02)	.001	0.06 (0.02)	<.001	0.02 (0.00)	<.001	0.01 (0.00)	<.001
	MCC	0.02 (0.01)	.037	0.04 (0.01)	<.001	−0.02 (0.00)	<.001	0.00 (0.00)	<.001

Note. SES = socioeconomic status based on parental education.

Behavioral Problems Development on Average

The quadratic model was the preferred model for all measures of behavioral problems in both cohorts. For internalizing problems, both growth factor means were not significantly different from 0 in the ECC, indicating stability (see Figure 3d) The significant variance of the linear slope indicated variability between participants. In the MCC, a significant pattern of decelerating increase was found (see Figure 3d). The quadratic slope factor showed significant variance between participants.

With respect to externalizing problems, in both cohorts, all growth factors and their variance were significantly different from zero. In the ECC this indicated an average U-shaped pattern (see Figure 3d), whereas the MCC showed an average pattern of delayed decrease (see Figure 3d).

Cross-Lagged Panel Model of Prosocial Behavior and Behavioral Problems

Next, we tested the within-subject relations between prosocial behavior and behavioral problems (internalizing and externalizing) in the ECC and MCC. The standardized estimates of the four RI-CLPMs (all controlled for the impact of the VIPP-SD intervention) are presented in Figures 4 and 5 (see Figures S1 and S2 for unstandardized results). The associated model fit was acceptable for prosocial behavior in combination with internalizing problems in the ECC: $\chi^2(98, N = 440) = 475.52$, $p < .001$, CFI = .94, RMSEA = .09), and satisfactory in the other three models with CFIs > .95 and RMSEA <.08. The support aggregated over the different measures of prosocial behavior for the set of competing hypotheses is provided in Table 4.

Internalizing Behavioral Problems

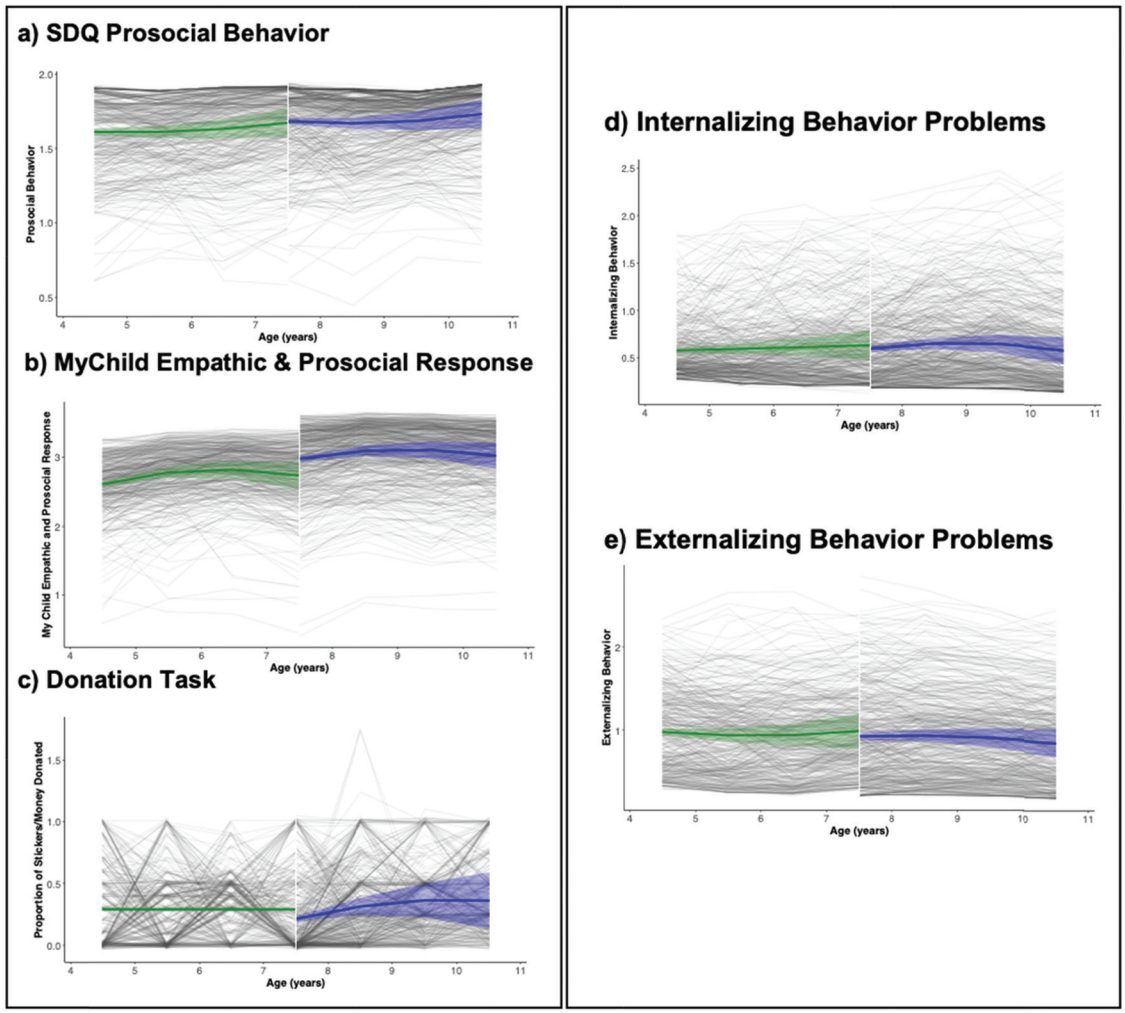
Table 4 provides the posterior model probabilities for each of the hypotheses in each of the measures separately and combined for the ECC and MCC. In both cohorts, each of the measures provided most support for H0. However, in the ECC substantial support was also found for effects from SDQ prosocial and donating behavior to internalizing problems and not the other way around (H1; 35% and 38% respectively). In the MCC, the hypothesis of an effect from internalizing problems to donating behavior (H2) received 23% probability. Overall, 98% and 99% of the support was for the null hypothesis of no within-person relation between prosocial behavior and internalizing problems in the ECC and MCC respectively. This means that we can confirm the null hypothesis with 98%–99% certainty. Note that the inclusion of sex as covariate did not change the conclusions of our cross-lagged panel models.

Parameter Estimates ECC. Looking at the parameter estimates of the ECC in more detail, we find that the cross-lagged behaviors for internalizing problems with prosocial behavior were all nonsignificant. Furthermore, we observe high auto-regressive paths (i.e., lagged effects) for MyChild empathic and prosocial response, SDQ prosocial behavior and internalizing problems in the ECC (Figure 4a). This means that when children deviated from their personal mean score at one time point, deviation in the same direction was still expected at the next occasion. Furthermore, there was a positive correlation between the MyChild empathic and prosocial response and SDQ prosocial scores within children ($r = .61$), meaning that deviating levels of MyChild empathic and prosocial response co-occurred with deviating levels of SDQ prosocial scores in the same direction. This correlation also existed at the between level ($r = .84$), meaning that children with higher scores on MyChild empathic and prosocial responses, also scored higher on SDQ prosocial behavior and vice versa.

Parameter Estimates MCC. In the MCC (see Figure 4b), the cross-lagged paths were not statistically significant either, meaning that personal deviations on one variable were hardly predictive for deviations on another variable at the next occasion. The auto-regressive paths for internalizing problems, SDQ prosocial scores, and donating behavior were significant, indicating that deviations at one occasion were predictive of deviations in the same direction at the next occasion. However, the autoregressive path for MyChild empathic and prosocial responses was not significant, meaning that scores varied randomly from one occasion to the next. Furthermore, we observed four significant correlations between the random intercepts. Children with higher scores on SDQ prosocial behavior showed fewer internalizing problems ($r = -.19$). Children with higher MyChild empathic and prosocial response scores also had higher SDQ prosocial scores ($r = .80$) and donated more ($r = .48$). Children with higher donating scores

Figure 3

Predicted Trajectories With 95% Confidence Intervals and Observed Data in the ECC and MCC Cohorts



Note. Some children donated their own money in addition to the money received, resulting in a donated proportion >1. See the online article for the color version of this figure.

had higher SDQ prosocial behavior scores (r = .47). The correlation between MyChild empathic and prosocial response and SDQ prosocial scores also existed within children (r = .53), meaning that deviations in both variables co-occurred in the same direction.

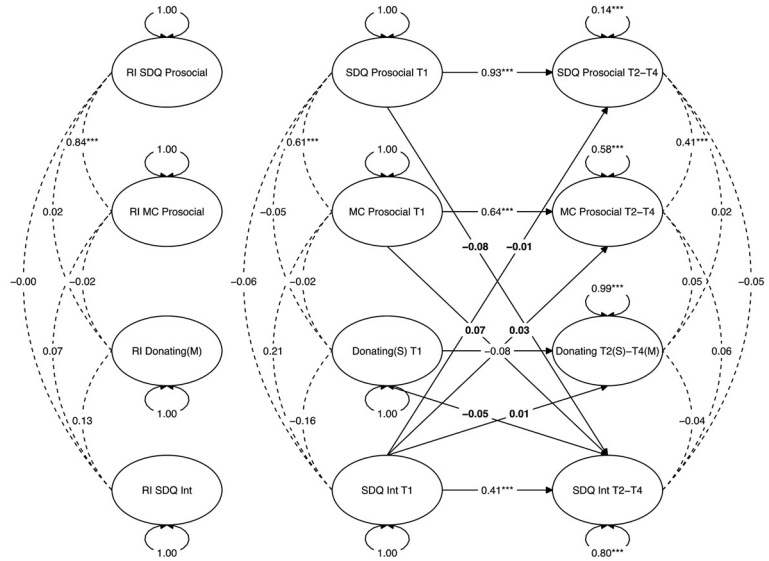
Externalizing Behavioral Problems

In the ECC (see Table 5), all measures provided substantial support for the null hypothesis. The SDQ prosocial, however, also showed support for H2: A negative within-person cross-lagged relation from prosocial behavior to behavioral problems, but not vice versa. Overall, most support was found for the null hypothesis (85%) with the remaining 15% support for H2. In the MCC (see Table 5), the support differed among measures. The null hypothesis received most support from the MyChild empathic and prosocial response questionnaire. The SDQ prosocial scale demonstrated most support for the alternative hypothesis, implying positive cross-lagged relations. Donating data best supported H2: A negative within-person cross-lagged relation from behavioral problems to prosocial behavior, but not vice versa. Overall, 49% of the support was for the null hypothesis, and 38% for H2. Another 13% support was for the unspecific alternative hypothesis, see Table 5. Note that the inclusion of sex as covariate did not change the conclusions of our cross-lagged panel models.

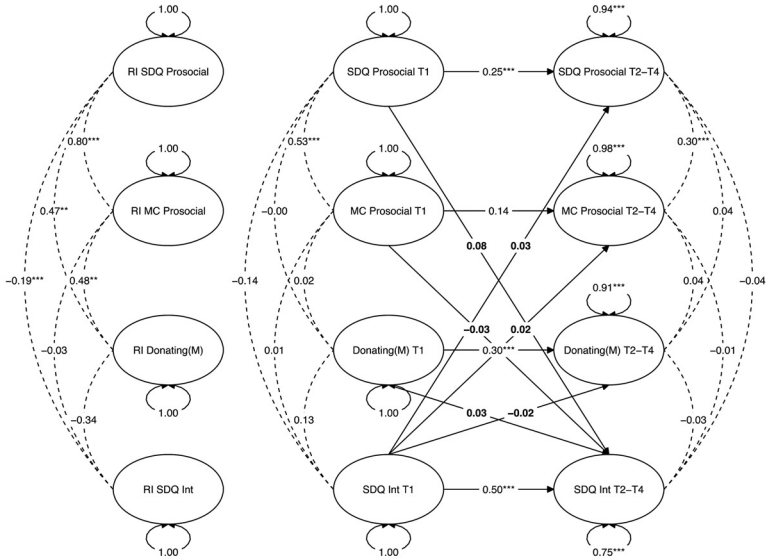
Parameter Estimates ECC. Looking at the parameter estimates of the ECC in more detail (Figure 5a), all parameters concerning prosocial behavior only (e.g., auto-regressive paths and correlations within and between persons) were of course highly similar to those described in the internalizing problems model as the behavioral problem variable is the only change compared to the model with internalizing problems. Focusing on externalizing problems, we observed a strong auto-regressive path, indicating that deviations at one time point were predictive of deviations in externalizing problems in the same direction at the next time point. There was also a negative correlation within children between SDQ prosocial scores and externalizing problems, indicating that elevated prosocial levels co-occurred with lower externalizing problems.

Figure 4

The Standardized Results of Cross-Lagged Panel Model for Internalizing Behavioral Problems in Early Childhood (a) and Middle Childhood (b) for Cross-Lagged and Autoregressive Paths



a



b

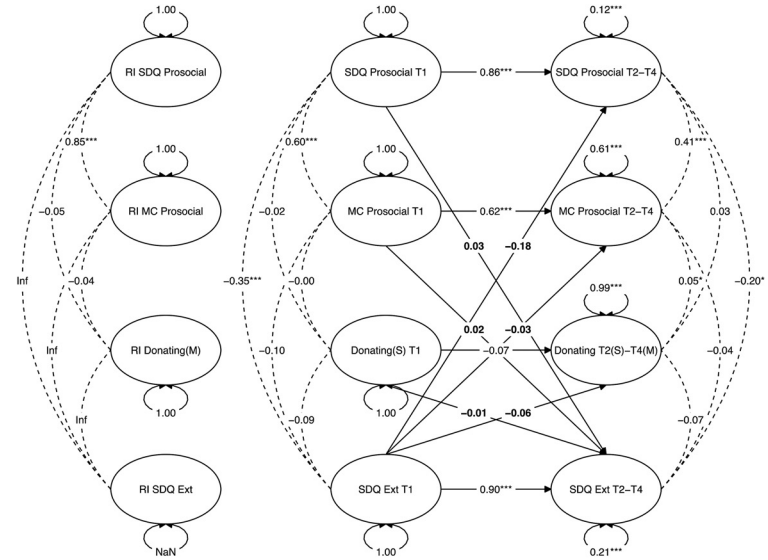
Parameter Estimates MCC. In the MCC (Figure 5b), most auto-regressive paths were again significant. The negative correlation between the random intercepts of SDQ prosocial scores and externalizing behavior was significant ($r = -.27$), indicating that children with higher prosocial behavior show fewer externalizing problems. Within children, there was a negative cross-lagged path from externalizing problems to money donation, indicating that increased levels of externalizing problems predict lower amounts of money donated at the next occasion. There is also a significant positive cross-lagged path from SDQ prosocial behavior to externalizing problems, indicating that elevated levels of prosocial behavior predicted increased externalizing behavior at a next occasion.

Sensitive Windows

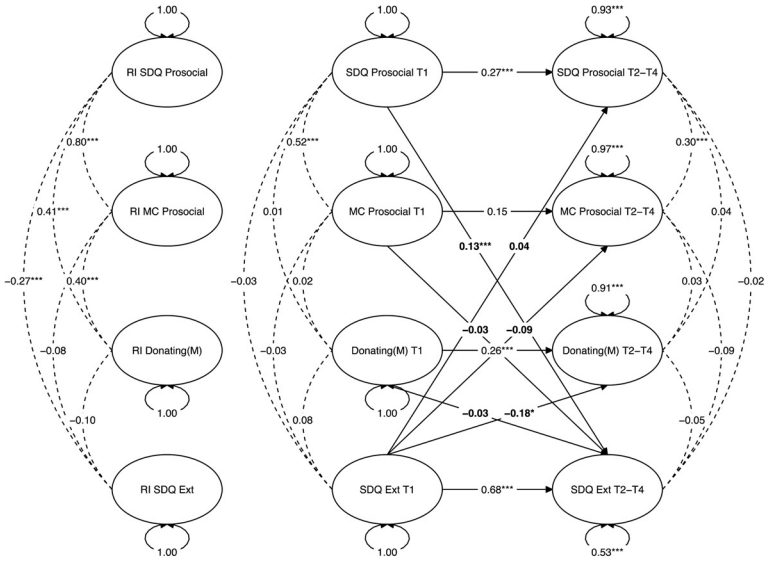
As preregistered, we compared the loadings of the cross-lagged paths between ECC and MCC to investigate possible sensitive windows. That is, stronger negative cross-lagged paths from prosocial behavior to behavioral problems in one cohort over the other would indicate a better opportunity (i.e., sensitive window) to promote

Figure 5

The Standardized Results of Cross-Lagged Panel Model for Externalizing Behavioral Problems in Early Childhood (a) and Middle Childhood (b) for Cross-Lagged and Autoregressive Paths



a



b

prosocial behavior in order to decrease behavioral problems. However, for both internalizing and externalizing behavior the standardized negative paths were negligible in size and none of them were significantly different from zero, so we could not prioritize one sensitive window over the other as an ideal time frame for prosocial interventions aimed at reducing behavioral problems.

Discussion

Several studies have shown that, between children, those high on prosocial behavior are usually low on behavioral problems, indicating that prosocial behavior could serve as a protective factor for behavioral problems. Following these results, several researchers have suggested that enhancing prosocial behavior (e.g., by interventions or training) might decrease behavioral problems. However, such an intervention would only be successful if there are significant within-person associations from prosocial behavior to behavioral problems. The current study first described average developmental patterns and then tested within-person associations using random-intercept cross-lagged panel models (RI-CLPM; Hamaker et al., 2015) during early and middle childhood (4–8 years and 7–11 years) with three different measures of prosocial behavior.

Table 4
Posterior Model Probabilities for Internalizing Problems

Measure	H0	H1	H2	H3	Ha
Early childhood cohort					
SDQ prosocial	**.55**	.35	.05	.03	.01
MyChild empathic and prosocial response	**.91**	.03	.04	.00	.02
Prosocial donating	**.56**	.38	.02	.02	.01
All	**.98**	.02	.00	.00	.00
Middle childhood cohort					
SDQ prosocial	**.88**	.03	.08	.00	.01
MyChild empathic and prosocial response	**.83**	.12	.03	.01	.00
Prosocial donating	**.73**	.02	.23	.00	.02
All	**.99**	.00	.01	.00	.00

Note. The largest probability in each row is formatted in boldface. H0: The cross-lagged relations are all equal to zero (i.e., no effects). H1: Negative within-person cross-lagged relation from prosocial behavior to behavioral problems, but not vice versa. H2: Negative within-person cross-lagged relation from behavioral problems to prosocial behavior, but not vice versa. H3: Negative within-person cross-lagged relation from prosocial behavior to behavioral problems *and* vice versa. Ha: Anything else.

Average Development of Prosocial Behavior

We investigated between-person development of prosocial behavior using both parent-report questionnaires and a donating paradigm. For this study, we included a measure of prosocial behavior and one that additionally measured empathy, as these two constructs are closely related but not identical (Eisenberg et al., 2014; Knafo-Noam et al., 2015). Findings with respect to average developmental patterns support a distinction between the two, as we found different developmental patterns for parent-reported SDQ prosocial behavior and MyChild empathic and prosocial response in early and middle childhood. Prosocial behavior appeared stable in early childhood, combined with a pattern of delayed increase in middle childhood. In contrast, we found decelerated increases of empathic and prosocial responses in both early and middle childhood. Considering that earlier work reported overall increases as well as decreases of prosocial behavior and empathy across childhood (Fehr et al., 2008; Guroglu et al., 2014; Knafo & Plomin, 2006) it is interesting to note our finding on stability of prosocial behavior in early childhood.

Interestingly, we also found increases in donating behavior in middle childhood, which is in line with our finding of general prosocial behavior as reported by the parents. It should be noted that the pattern of decelerated increase was found consistently across the four waves in middle childhood, even though in the latest wave a larger amount of money was made available for donation. We therefore believe that the increased amount of money was a good fit to the developmental stage of our participants. In early childhood we observed stability of donating behavior, but no firm conclusions could be drawn due to a seemingly random response to the task in this age group, as indicated by very low auto-regressive paths. Although the donating task has been used extensively in previous studies in middle childhood (Thijssen et al., 2015; van IJzendoorn et al., 2010; Wildeboer et al., 2017; Wildeboer et al., 2018), it is possible that the task is less suitable for young children (that participated in the ECC). The donating task requires a child to imagine an unknown peer and to decide whether to donate tokens to that peer or not. For young children this might be particularly difficult as they might lack the sociocognitive processes required for such advanced social decision making (that is, imagining donating stickers to an unknown imagined peer; Junge et al., 2020). The behavior shown might, therefore, not be an adequate reflection of young children's prosocial behavior. Moreover, the type of donating task was not consistent across the ECC waves. To have suitable overlap in our cohort-sequential design, we decided to administer the same donating version for 7- to 8-year-olds in the ECC (last wave) as in the MCC (all waves). Thus, whereas the first three timepoints of the ECC have a donating task

Table 5
Posterior Model Probabilities for Externalizing Problems

Measure	H0	H1	H2	H3	Ha
Early childhood cohort					
SDQ prosocial	.43	.01	**.52**	.02	.03
MyChild empathic and prosocial response	**.85**	.03	.10	.00	.01
Prosocial donating	**.83**	.09	.07	.01	.00
All	**.85**	.00	.15	.00	.00
Middle childhood cohort					
SDQ prosocial	.18	.00	.05	.00	**.77**
MyChild empathic and prosocial response	**.80**	.08	.10	.01	.01
Prosocial donating	.25	.01	**.59**	.10	.04
All	**.49**	.00	.38	.00	.13

Note. The largest probability in each row is formatted in boldface. H0: The cross-lagged relations are all equal to zero (i.e., no effects). H1: Negative within-person cross-lagged relation from prosocial behavior to behavioral problems, but not vice versa. H2: Negative within-person cross-lagged relation from behavioral problems to prosocial behavior, but not vice versa. H3: Negative within-person cross-lagged relation from prosocial behavior to behavioral problems *and* vice versa. Ha: Anything else.

with stickers, the last wave includes donating money, which might be an additional explanation of the very low auto-regressive paths that were observed in the younger cohort.

Average Development of Behavioral Problems

We also investigated the average developmental trends of behavioral problems, using parent-reported SDQ measures. On average, internalizing problems remained stable across early childhood, which is in line with prior findings of parent-reported internalizing problems in this age range (Keiley et al., 2000; Stone et al., 2016). Additionally, in middle childhood we observed a pattern of decelerated increase over time, that seemed to decrease around the age of 9 to 10 (see also Achterberg et al., 2021). Leve and colleagues also reported an increase in these behaviors until the age of 10, with decreases that continued until the age of 17 (Leve et al., 2005). Follow-up waves in the L-CID study might give more insight into whether this pattern of decreasing internalizing problems indeed continues into early adolescence.

In contrast to internalizing behavior, externalizing problems showed an average U-shaped developmental pattern across early childhood and a decelerating decrease across middle childhood. Prior research also reported a decrease in externalizing problems (Leve et al., 2005; Stone et al., 2016) although developmental patterns may somewhat differ for boys and girls (Bongers et al., 2003) and for different reporters (Keiley et al., 2000).

Note, however, that in a population sample like ours, the prevalence of behavioral problems is relatively low. In a clinical population, such as children with autism spectrum disorder, one might expect more behavioral problems (Bauminger et al., 2010), with potentially different developmental trajectories. However, it is also possible that parental bias might have influenced our results. Furthermore, because the SDQ has only 10 items associated with internalizing problems, and nine statistically meaningful items in this study for externalizing problems, it is difficult to draw conclusions about the full range of behaviors associated with internalizing and externalizing problems. However, we do believe that the SDQ provides sufficient information in our population sample to provide some insight in the behavioral problems of our participants. We encourage future studies to include additional measures to capture a broader variety of behavioral problems.

Random Intercept Cross Lagged Panel Models

In line with previous studies (Flynn et al., 2015; Memmott-Elison et al., 2020) we observed a significant between-person association between prosocial behavior and behavioral problems in middle childhood. That is, our RI-CLPMs showed that the random intercepts of parent-reported prosocial behavior and parent-reported internalizing and externalizing behavior were significantly negatively associated in middle childhood. Interestingly, we did not find a significant between-person association between prosocial behavior and behavioral problems in early childhood, indicating developmental differences in between-person associations. In both early and middle childhood, the RI-CLPM provided robust support for the null hypothesis that within-person changes in prosocial behavior do not relate to later changes in internalizing behavior and vice versa, with model probabilities up to 99%. Indeed, in both early and middle childhood, the model showed no significant cross-lagged associations between (different measures of) prosocial behavior and internalizing behavior, or vice versa. Thus, although we report significant between-persons associations between internalizing behavior and prosocial behavior in middle childhood, on a within-person level these associations did not have support. These results indicate that in general, children in middle childhood might be high on internalizing behaviors and low on prosocial behavior, but there is no causal relation between the two on a within-person level. The results on both early and middle childhood thus providing little support for the suggestion that targeting prosocial behavior in interventions would successfully diminish internalizing problem behavior.

For externalizing behavioral problems, the RI-CLPMs were less conclusive. In both early and middle childhood, the models provided the most support for H0 (all relations are equal to zero), but the model probabilities were lower for MCC than ECC (49% and 85%, respectively). Specifically, the RI-CLPM for MCC also provided substantial (38%) support for the hypothesis that there is a negative within-person cross-lagged relation from behavioral problems to prosocial behavior (H2), indicating that an increase in behavioral problems relates to a decrease in future prosocial behavior. Looking at the separate cross-lagged paths, we found a significant negative path from externalizing behavior to costly prosocial behavior, such that 7- to 11-year-old children increasing in externalizing problems behavior later donated less money to charity. This effect was not observed in early childhood, however, as noted before, donating behavior in early childhood was instable, with very low auto-regressive paths. However, in early childhood there was also some support for H2 (increase in behavioral problems relates to a decrease in future prosocial behavior), as we found a negative cross-lagged path between externalizing behavior to SDQ prosocial behavior. Possibly, the associations between MCC and ECC are comparable, but prosocial behavior is more accurately measured by the experimental design in MCC (Hao, 2017; Wildeboer et al., 2017), whereas parental report might be more accurate for ECC (Huber et al., 2019). That is, parental report might be more suitable for younger children, as the experimental task might be too difficult and because parents are in close proximity to social interactions of younger children (relative to older children). It should be noted, however, that although H2 was somewhat supported in both cohorts, in both cohorts the overall support was for H0, indicating no cross-lagged relations between prosocial behavior(s) and externalizing problem behavior.

When comparing the results for MCC and ECC to see possible developmental differences, we noted a positive path from SDQ prosocial scores to externalizing behavior in middle childhood (but not in early childhood), implying that increased prosocial behavior in middle childhood would predict increases in behavioral problems as well. One explanation for this effect would be that increased assertiveness boosts both positive (prosocial) and negative (externalizing) behavior. Prior research identified a subgroup of "prosocial risk-takers," who were both prosocial and rebellious. Sensation seeking, which can be considered a form of assertiveness, predicted both types of behaviors (Blankenstein et al., 2020). Furthermore, children may use a combination of prosocial and aggressive strategies to gain social status (Hartl et al., 2020; Hawley, 2003). These children might be especially responsive to their environment, thereby showing both prosocial and

self-protective aggressive behaviors, based on the social context (Crone et al., 2020; Dobbelaar et al., 2020). This effect was not observed in early childhood and these developmental differences might arise from developmental differences in social relations and peer status. That is, whereas older children might be able to employ an array of strategies in order to increase or maintain their social status (including combinations of prosocial and aggressive behaviors; Hawley, 2003), younger children might not yet have the sociocognitive abilities necessary to toggle these strategies. Instead, they might prefer to show either prosocial behavior or a lack of problem behavior in order to secure their social status (but see, Nelson et al., 2005).

Note that in both cohorts we did not find support for H1 (i.e., there is a negative within-person cross-lagged relation from prosocial behavior to behavioral problems, but not the other way around). So, despite finding a positive path in MCC in one of our prosocial measures, overall there is little support for the suggestion that an increase in prosocial behavior would result in a decrease of externalizing behavior on a within-person level. In line with our findings on internalizing behavior, these findings would argue against the notion that training prosocial behavior might facilitate developmental outcomes.

Methodological Considerations

Thus, none of the models provided support for a causal within-person relation where increased prosocial behavior resulted in decreased behavioral problems. However, several methodological considerations should be taken into account. First, the number of estimated parameters (i.e., 70 or 72, depending on the model) was high in relation to the number of participants (i.e., ECC = 440, MCC = 514), especially given the cluster-correction for including twins. As long as a null hypothesis is included, frequentist and Bayesian hypothesis evaluation suffer from some form of power issues. In the current analysis, however, we considered the null hypothesis to be a relevant hypothesis.

Second, our design included annual measures of prosocial behavior and behavior problems, while the causal effects may occur in a shorter interval, and hence be missed by our model (Frijns et al., 2020). In that sense, the negative within-person correlation in the ECC between SDQ prosocial scores and externalizing behavior problems may point to a causal effect that occurs within a shorter time-interval. Future research might use shorter intervals, for example by implementing experience sampling methods (EMA) or daily diaries.

Third, the questionnaires used to measure prosocial behavior, empathy, and behavioral problems were completed by the same parent, which might result in rater bias. Although parents are valid informants, especially in early and middle childhood, some behaviors might be more difficult to reflect on by the parent (Youngstrom et al., 2000). For example, internalizing behavior might be better suited for self-report, as these kind of behaviors (i.e., having many worries or being picked on by other children) might not be explicitly picked up by external parties.

Last, as mentioned before, we specifically included a population sample. However, in contrast to a clinical sample, the prevalence of—and variation in—behavioral problems is relatively low. Our results indicate that targeting prosocial behavior in a typically developing population sample would not result in within-individual decreases in problem behavior. However, this does not rule out the possibility that targeting prosocial behavior in a clinical sample, for example children with ASD, would also not be beneficial. As children with ASD display more problem behavior there might be more room for improvement in such a sample (Boonen et al., 2014). Therefore, future studies should examine within-person cross-lagged relations between prosocial behavior and problem behavior in clinical samples as well.

Implications

Our findings do not support the hypothesis that increased prosocial behavior relates to subsequent decreased behavioral problems, suggesting that intervening on these types of prosocial behavior might not result in diminished behavioral problems. However, we do not argue against the possibility that other types of prosocial behavior can work as protective factor in developing behavioral problems. Rather, our findings emphasize the importance of taking into account the multifaceted nature of prosocial behavior (El Mallah, 2020), because we found some differential effects for our three measures of prosocial behavior. For example, it might be of additional importance to take into account the recipient of the prosocial behavior when investigating effects on behavioral problems(Crone & Achterberg, 2021; Padilla-Walker et al., 2015). For example, 4-years-olds already distinguish in prosocial allocation between friends and strangers (Moore, 2009). Possibly, these prosocial acts toward friends might have a larger impact on behavioral problems compared with prosocial behavior toward strangers (as measured in the donating paradigm), for example through increased friendship quality (Son & Padilla-Walker, 2020). Additionally, there might still be positive effects of interventions enhancing prosocial behaviors on behavioral problems through a third variable. That is, previous studies have shown that prosocial behavior resulted in stronger feelings of belonging in adolescents, which in turn might lead to less behavioral problems (Mesurado et al., 2019). Future research on prosocial interventions could endeavor to disentangle such transfer and far-transfer effects by including different but related constructs as outcome variables.

Summary

We report a gradual developmental increase in prosocial behavior across measures. Internalizing problems were relatively stable in the ECC, but slightly increased in the MCC. The development of externalizing problems differed between participants, with a decreasing trend after a peak at 7–8 years. In line with the literature, we found a significant between-person association between internalizing and externalizing behavioral problems and parent-reported prosocial behavior in middle childhood (Flynn et al., 2015; Memmott-Elison et al., 2020), and to a lesser degree in early childhood. However, RI-CLPMs suggest that there were no within-person associations over time between prosocial behavior in general and behavioral problems. That is, the RI-CLPMs provided most support for the hypothesis that the cross-lagged relations are all equal to zero. We found no evidence that natural deviations in prosocial behavior would affect later internalizing problems. Some evidence was found that deviations in externalizing

problems affect later prosocial behavior in middle childhood, but not in early childhood, suggesting developmental differences in this within-person association. All in all, we found no evidence for a direct association between increased prosocial behavior and decreased behavioral problems in our population-based twin sample. Future research should aim to investigate possible moderating and mediating mechanisms in the association between prosocial behavior and internalizing and externalizing behavioral problems.

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