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Parent-Adolescent Discrepancies Regarding Adolescents' Peer-Related Loneliness: Associations with Adolescent Adjustment

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Abstract Because loneliness is a subjective experience, it is often examined using self-reports. Yet, researchers have started to use other-reports to examine loneliness. As previous research suggests that discrepancies between self- and other views might have important implications for adolescents' mental health, the current study examines discrepancies in multi-informant reports on adolescents' loneliness in relation with prosocial behavior, aggression, and adolescents' parent-related loneliness. The sample consisted of 374 mother-adolescent dyads and 318 father-adolescent dyads (41.80% male, $M_{age} = 15.67$ years, $SD = 1.25$). Results indicated that informants used different reference points to assess adolescents' peer-related loneliness, but were otherwise comparable. Moreover, informant discrepancies were associated with greater adolescents' reported parent-related loneliness. The current study did not provide evidence that discrepancies were related to prosocial or aggressive behavior. The current study adds to the notion that other-reports on loneliness show substantial convergence with self-reports. In addition, this study indicates that the discrepancy between other- and self-reports on loneliness holds valuable information for adolescent socio-emotional adjustment.

Keywords Loneliness · Discrepancies · Parent-reports · Aggressive behavior · Prosocial behavior · Adolescents

Introduction

Loneliness is a negative emotional reaction to the experience of a discrepancy between the perceived and the desired quantity or quality of social relations (Perlman and Peplau 1981). By definition, therefore, it represents a subjective, internal experience, for which self-reports are deemed most appropriate (Heinrich and Gullone 2006). Yet, some lonely individuals exhibit certain observable characteristics, such as being less trusting or warm (Tsai and Reis 2009), having lower social skills (Lodder et al. 2016), having fewer friends (Qualter and Munn 2005), and being more shy (Vanhalst et al. 2014). These observable characteristics of lonely individuals suggest that loneliness could be assessed using other-reports instead of self-reports. The only study that included and compared multiple informants on late adolescent loneliness showed that self-reports and reports from parents, peers, and partners are moderately to highly correlated (Luhmann et al. 2016). This indicates that other-reports may be useful to some extent, but it remains unclear what the added value is of these other-reports compared to self-reports.

It might be especially interesting to examine what it means if self-reports and other-reports on loneliness are discrepant. Earlier research indicated that, in general, discrepancies between reporters may hold valuable information that predicts adolescent adjustment above and beyond individual informant reports (Vazire and Carlson 2011). For instance, discrepant reports of adolescent and parents on

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family functioning have been related, above and beyond individual reports, to lower self-competence (Ohannessian et al. 2000), increased adolescents' anxiety and increased alienation from the parents (Maurizi et al. 2012). Using state-of-the-art statistical analyses, in this article we examined if and how discrepancies between self- and parent-reports of adolescents' peer-related loneliness were related to adolescents' interpersonal functioning in the peer context, both positively (i.e., prosocial behavior) and negatively (i.e., aggressive behavior), and to their relation with the respective parent (i.e., parent-related loneliness).

Discrepancy Assessment

In order to establish whether there are discrepancies between two informants regarding a certain behavior, several methods have been used in the past. In the first approach, informants report on parallel items with slight differences in content (De Los Reyes et al. 2015). The well-known Child Behavior Checklist (CBCL) and Youth Self Report (YSR) are considered to be such parallel questionnaires, as the CBCL item "Underactive, slow moving, or lacks energy", for example, is supposed to match the YSR item "I don't have much energy". However, on these kinds of parallel measures, it remains unclear to what extent discrepancies are the result of different informant perspectives vs. variability in item content. In the second approach, discrepancies are examined by using "identical items" for all informants (De Los Reyes et al. 2015). A frequently used approach for such questionnaires is changing the "I" in adolescent questionnaires to "my child" in parent questionnaires, or vice versa. Not surprisingly, informants are more likely to agree on identical items than parallel items (average correlation of 0.45 vs. 0.30; Achenbach et al. 2005).

The use of identical items does not guarantee comparability of the informant reports (De Los Reyes and Ohannessian 2016). For instance, if children consistently interpret certain questions differently than their parents do, discrepancies in scores may reflect differences in interpretation of the question rather than actual differences in the observed behavior. Therefore, it is important to know whether discrepancies between adolescents' and parents' reports regarding adolescents' peer-related loneliness reflect actual differences in perspective on adolescents' loneliness instead of differences in the use or interpretation of the questionnaire.

Comparability of informant reports, which is referred to as measurement invariance, is usually examined on three levels (van de Schoot et al. 2012). On the first level, researchers examine whether parents and adolescents conceptualize the assessed construct, that is, peer-related loneliness, in the same way (i.e., configural invariance).

On the second level, researchers examine whether parents and adolescents agree in what they see as the most important indicator of the assessed construct (i.e., metric invariance). For example, it might be easier for parents to obtain information about observable symptoms compared to non-observable symptoms (e.g., De Los Reyes et al. 2015). Parents would then be more likely to attach greater value to observable indicators (e.g., behavior), whereas adolescents would be more likely to attach greater value to non-observable indicators (e.g., emotions; Carlston and Ogles 2006). On the third level of measurement invariance, researchers examine whether parents and adolescents might use similar reference points for what they consider as typical behavior regarding peer-related loneliness (i.e., scalar invariance). It has been suggested that adolescents are more likely to use behaviors of their friends and peers in unsupervised contexts as reference point. Parents, by contrast, are more likely to use their own behavior during adolescence or the behavior of their adolescents' peers in supervised contexts as reference point (Carlston and Ogles 2006). Some deviations in the concept's indicators are allowed in order to make meaningful comparisons between parent- and adolescent-reports, which means that partial invariance is sufficient for meaningful comparison (van de Schoot et al. 2012).

In addition to different ways to assess informant comparability, previous studies have also adopted several approaches to analyze informant discrepancies (De Los Reyes and Ohannessian 2016). These analyses are usually based on inter-informant agreement, such as difference scores or comparison of informant mean scores. However, these methods reduce reliability of the measures, are ambiguous in their interpretation, place unwanted mathematical constraints upon the data (e.g., adolescents' and parents' reports are assumed to be equal in size, but opposite in direction), and confound the effects of individual informants' reports (e.g., Laird and De Los Reyes 2013). Polynomial regression analysis with surface modeling has been proposed as a viable alternative for using difference scores (Edwards 2002). Compared to difference scores, the added value of polynomial regression analysis is that it can be used to examine both the degree to which parents' reports differ from adolescents' reports and the direction of this difference (i.e., does it matter if the adolescents' report is higher compared to the parents' report or vice versa) regarding a particular outcome.

Predictive Utility of Informant Discrepancies Regarding Adolescent Loneliness

It has been suggested that others may notice behavioral changes related to loneliness, such as social withdrawal and depressive symptoms, and perceive them as signs of

loneliness and as indications that the lonely individual needs help (Cacioppo et al. 2014). This suggests that the perspective of others regarding the individual's loneliness matters, as it determines whether or not the individual receives help. Moreover, it suggests that discrepancies between the perspective of self and others regarding the individual's loneliness might be disadvantageous for the individual. The current study, therefore, examines self- and other-discrepancies regarding adolescents' loneliness, and whether such discrepancies are related to adolescents' functioning. To examine adolescents' functioning, we selected variables related to the parental context (i.e., parent-related loneliness) as well as the peer context (i.e., aggressive and prosocial behavior), as both contexts are crucial to adolescents' development (Larson et al. 1996; Steinberg and Morris 2001).

First, despite adolescents' striving for greater autonomy from their parents, parents remain important socializing agents (Steinberg and Morris 2001). Parents are key providers of attachment, guidance, reassurance of worth, and opportunities for nurturance (Weiss 1973). When these provisions are not being met, adolescents might experience loneliness in relation to their parents (i.e., parent-related loneliness). It should be noted that parent-related loneliness is not limited to low quality of the parent-adolescent relationship, as parent-related loneliness also implies additional feelings of alienation and abandonment (Goossens 2016). Besides unmet provisions, parent-related loneliness might also result from discrepant parent-adolescent views regarding adolescents' loneliness. More specifically, it has been suggested that discrepancies between self and other perceptions regarding an individual's adjustment can result in feeling alienated from the other person, as well as unsupported, and unaccepted by the other person (Goodman et al. 2010). In this study, therefore, we hypothesized that parent-adolescent discrepancies regarding adolescents' peer-related loneliness are related to increased parent-related loneliness, as reported by the adolescent.

Second, it has been suggested that loneliness results in more negative interpersonal behaviors in the peer context, such as increased aggressive behavior and decreased prosocial behavior, through impaired cognitive processes (Twenge et al. 2007). More specifically, the cognitive processes of lonely individuals are focused on their own needs and preservation (Cacioppo and Hawkey 2009; Qualter et al. 2015), which does not necessarily result in "nice" or positive behavior towards others (Twenge et al. 2007). Moreover, the bias in cognitive processes of lonely individuals shows similarities with the cognitive bias of aggressive individuals (e.g., Crick and Dodge 1994). Indeed, experimental studies showed that priming loneliness led to less prosocial behavior (Twenge et al. 2007) and more aggressive behavior (Twenge et al. 2001). In

addition, it has been suggested that discrepant self and other perspective regarding loneliness might also result in increased aggressive behavior and decreased prosocial behavior. That is, self-verification theory suggests that perceptions of others that are discrepant with one's own perceptions pose a threat for one's self-concept, even if the perception of others is more favorable (Swann 1990). Individuals can blame the other person for the difference in perspective in order to protect themselves against the self-concept threat, which is likely to result in hostility and anger towards the other person (Tracy and Robins 2003). In this study, we hypothesized that parent-adolescent discrepancies regarding adolescents' peer-related loneliness are related to increased aggressive behavior and decreased prosocial behavior.

The Present Study

In the current study, we examined whether parent-adolescents discrepancies regarding adolescents' peer-related loneliness whether relation to adolescents' parent-related loneliness, as indicator of the relationship with the reporter, and to aggressive behavior and prosocial behavior, as indicators of interpersonal behaviors in relation to peers. Moreover, we examined comparability between adolescents' and parents' reports on identical items regarding adolescents' peer-related loneliness. We also examined the comparability of mothers' and fathers' reports with each other, as it might provide greater insight into potentially different results for adolescent-mother and adolescent-father dyads.

We expected that adolescents' peer-related loneliness is related adolescents reporting increased parent-related loneliness (Maes et al. 2015b), increased aggressive behavior (Twenge et al. 2001), and decreased prosocial behavior (Twenge et al. 2007). Moreover, we expected that discrepancies between parents and adolescents on their reports regarding adolescents' peer-related loneliness to be related to increased feelings of loneliness in relation to that person (Goodman et al. 2010). In line with the self-verification theory (Swann 1990), we further expected that parent-adolescent discrepancies regarding adolescents' peer related loneliness would be related to an increase in aggressive behavior and decrease in prosocial behavior.

Method

Participants and Procedure

Data for this study were collected in third to sixth grade of three secondary schools in the Dutch-speaking part of

Belgium (comparable to US Grades 9 through 12). 2 weeks before the start of the study, parents were informed about the study through a letter, and they were provided with the researchers' full contact information. The letter also requested consent for the parents' own and their child's participation. On the day of data collection in the school, all adolescents received a letter describing the study, and were asked to indicate whether they wanted to participate or not. Adolescents who were willing to participate and whose parents did not object to participation filled out the questionnaires in their classroom, supervised by trained undergraduate students. The study consent process and procedures were approved by the university's Institutional Review Board.

In the full sample, 657 adolescents participated. Because of our interest in the mother-adolescent and father-adolescent dyads, 239 adolescents without a participating parent were not included in subsequent analyses. In addition, 26 cases were dropped from the study, because only one parent report but no adolescent reports or report of the other parent were available. One additional participant was dropped, because with the exception of 6 parent- and peer-related loneliness items, no adolescent information was available for the other variables of interest. The final analytic sample consisted of 301 adolescents (76.98%) for whom both parents participated, 73 adolescents (18.67%) for whom only the mother participated, and 17 adolescents (4.34%) for whom only the father participated. This resulted in 374 mother-adolescent dyads and 318 father-adolescent dyads. The adolescents (41.79% male) were between 13 and 19 years old, with an average age of 15.67 years ($SD = 1.25$). The majority (85.09%) lived with both their parents, 13.11% of the adolescents had divorced parents and for 1.80% of the adolescents one of the parents was deceased. Adolescents from traditional families (i.e., two biological parents) did not differ from adolescents from non-traditional families (i.e., living with one biological parent or in constituted families) in their self-reported parent-related loneliness ($t(387) = 1.04, p = .298$), self-reported peer-related loneliness ($t(387) = -1.48, p = .140$), mother-reported peer-related loneliness ($t(370) = -.77, p = .440$) and prosocial behavior ($t(387) = -.77, p = .440$). Adolescents from traditional families scored higher on aggressiveness ($t(387) = -2.21, p = .028$) and father-reported peer-related loneliness ($t(315) = -2.38, p = .022$) than adolescents from non-traditional families.

For the mother-adolescent dyads, 94.12% had complete data, 4.55% had one item missing, and 1.33% had a missing on a few items. For the father-adolescent dyads, 93.71% had complete data, 4.72% had one item missing, and 1.57% had a missing on a few items. Little's MCAR Test (Little 1988), using expectation maximization estimation, revealed a normed χ^2 of 1.15, which indicated that the data was

missing at random (Ulman 2013). Therefore, we imputed missing data using relative means substitution (Raaijmakers 1999) in SPSS before analyzing the data.

Measures

Loneliness

Adolescents' loneliness was measured using the peer- and parent-related loneliness subscales of the Loneliness and Aloneness Scale for Children and Adolescents (LACA; Goossens 2016). Both scales consist of 12 items (e.g., "I feel sad because I do not have friends", and "I feel left out by my parents", respectively), which the adolescents rated on a 4-point Likert scale, ranging from 1 (*never*) to 4 (*often*). The questionnaire has been shown to be a valid (Goossens 2016) and reliable measure of loneliness in various countries and age groups (Maes et al. 2015b). In addition, parents reported about their child's peer-related loneliness. A new scale was developed for that purpose by rewording all items of the peer-related loneliness subscale of the LACA (i.e., by replacing "I" with "My child"; see Table 1). An example item is "My child has fewer friends than others". Parents did not report on parent-related loneliness. Cronbach's alpha for peer-related loneliness as reported by the adolescent, mother, and father were excellent, $\alpha = .88$, $\alpha = .95$, and $\alpha = .95$ respectively. Cronbach's alpha for parent-related loneliness as reported by the adolescent was also excellent, $\alpha = .91$.

Prosocial behavior

Adolescents' prosocial behavior was assessed with 6 items that tapped into their helpfulness, supportiveness, and cooperativeness (Caprara et al. 2005). Adolescents rated these items (e.g., "I try to help others") on a 5-point Likert scale ranging from 1 (*almost never true*) to 5 (*almost always true*). There is some evidence for the validity of this questionnaire in adolescence (Caprara et al. 2012). Cronbach's alpha was good, $\alpha = .82$.

Aggressive behavior

Six items from the Aggression Behavior subscale of the Youth Self-Report (Achenbach et al. 1987) were used to assess aggressive acts towards others. This short form of the aggressive behavior subscale proved to be a reliable and valid measure in previous research (Soenens et al. 2012). Example items are "I am mean to others" and "I destroy things belonging to others". The items were answered on a 5-point Likert scale ranging from 1 (*almost never true*) to 5 (*almost always true*). Cronbach's alpha was good, $\alpha = .83$.

Table 1 Original and reworded items of the loneliness and aloneness scale for children and adolescents

| Item | Original questionnaire (Adolescents) | Reworded version (Parents) |
|------|---|--|
| 1 | I think I have fewer friends than others | I think that my child has fewer friends than others |
| 2 | I feel isolated from other people | I think that my child feels isolated from other people |
| 3 | I feel excluded by my classmates | I think that my child feels excluded by his/her classmates |
| 4 | I want to be better integrated in the class group | I think that my child wants to be better integrated in the class group |
| 5 | Making friends is hard for me | I think that making friends is hard for my child |
| 6 | I am afraid the others won't let me join in | I think that my child is afraid that the others won't let him/her join in |
| 7 | I feel alone at school | I think that my child feels alone at school |
| 8 | I think there is no single friend to whom I can tell everything | I think there is no single friend to whom my child can tell everything |
| 9 | I feel abandoned by my friends | I think that my child feels abandoned by his/her friends |
| 10 | I feel left out by my friends | I think that my child feels left out by his/her friends |
| 11 | I feel sad because nobody wants to join in with me | I think that my child feels sad because nobody wants to join in with him/her |
| 12 | I feel sad because I have no friends | I think that my child feels sad because he/she has no friends |

Statistical Analyses

Measurement invariance was tested using stepwise CFA analysis (van de Schoot et al. 2012). Full information maximum likelihood (FIML) was used to account for missing data as result of the different number of fathers and mothers that participated. In the first step, configural invariance was examined by testing a baseline latent factor model in which items should be associated with the same latent factor across informants. A good fit indicates that a similar conceptual framework for peer-related loneliness is used across adolescents, fathers, and mothers. In the second step, metric invariance was examined by constraining factor loadings to be equal for fathers, mothers, and adolescents, as well as for each dyad separately. A non-significant change in model fit in comparison to the configural model indicates that informants ascribe similar degrees of importance to the various indicators of peer-related loneliness. In the last step, scalar invariance was examined by constraining the intercepts to be equal, in addition to the already constrained factor loadings, for fathers, mothers, and adolescents, as well as for the dyads separately. A non-significant change in model fit in comparison to the metric invariant model indicates that levels and scaling of the items are similar across informants. If adding constrains to the model significantly worsens the model fit, one can establish partial measurement invariance by freeing parameters that do not show invariance. At least two parameters should be invariant for each latent construct for partial invariance to hold (van de Schoot et al. 2012). We used χ^2 , CFI, (with a value of 0.90 regarded as the cut-off for a good fitting model) and RMSEA (with a cut-off value of 0.05) to assess model fit in the configural model (Hu and Bentler 1999). In order to select the most parsimonious model (i.e., metric or scalar invariance), the change in χ^2 should not be significant and the change in CFI and RMSEA should be less than 0.01 (Chen 2007).

We examined whether similarities and differences in adolescents' and parents' reports on adolescents' peer-related loneliness were related to adolescents' parent-related loneliness, prosocial behavior, and aggressive behavior using polynomial regression analysis. In order to perform a polynomial regression analysis, the adolescents' and parents' reports on peer-related loneliness were centered around their mid-point (i.e., 2.5; Edwards 2002). The polynomial regression model was estimated with linear effects of the adolescent report (X) and the parent report (either father or mother; Y), an interaction between the parent and adolescent report (XY), and the squared term of the adolescent report (X^2) and the parent report (either father or mother; Y^2) regressed on parent-related loneliness, prosocial behavior, and aggressive behavior. The resulting equation for any given outcome is $b_0 + b_1X + b_2Y + b_3X^2 + b_4XY + b_5Y^2 + e$.

Only when the R^2 was significant, the polynomial regression analyses were evaluated on their surface test values (Edwards 2002). More specifically, the regression coefficients from the polynomial regression analysis were used to calculate the slope and curvature for the line of perfect agreement (a_1 and a_2 respectively), that is, the line where adolescents' and parents' reports were similar, as well as the slope and curvature for the line of disagreement (a_3 and a_4 respectively), that is, the line where adolescents' and parents' reports were different.

A significant slope along the line of perfect agreement ($a_1 = b_1 + b_2$) indicates that the outcome increases (positive a_1) or decreases (negative a_1) when the level of peer-related loneliness, as reported by both adolescent and parent, increases. Because we expect more peer-related loneliness to be related to more parent-related loneliness, more aggressive behavior and less prosocial behavior, a positive a_1 is expected for adolescents' parent-related loneliness and aggressive behavior, whereas a negative a_1 is expected for

prosocial behavior. A significant curvature along the line of perfect agreement ($a_2 = b_3 + b_4 + b_5$) indicates that the slope along the line of perfect agreement is non-linear. More specifically, such a curvature indicates that the outcomes increase (positive a_2) or decrease (negative a_2) more sharply when peer-related loneliness, as reported by adolescent and parent, increases. We did not have any expectations regarding non-linear effects.

A significant slope along the line of disagreement ($a_3 = b_1 - b_2$) indicates that the outcome is higher when adolescents report higher peer-related loneliness than their parents (positive a_3) or that the outcome is higher when parents report more peer-related loneliness than adolescents (negative a_3). We expect that parent-adolescent discrepancies in general threaten adolescents' self-concept and are thus, regardless of their direction, related to adolescents' parent-related loneliness, aggressive behavior, and prosocial behavior. In other words, we expect that a_3 is significant but do not have specific hypotheses about its direction (i.e., positive or negative). A significant curvature along the line of disagreement ($a_4 = b_3 - b_4 + b_5$) indicates that the slope along the line of disagreement is non-linear. More specifically, such a curvature indicates that the outcomes increase (positive a_4) or decrease (negative a_4) more sharply when the discrepancy between adolescent and parent reports increases (see also Shanock et al. 2010). We did not have any expectations regarding non-linear effects of parent-adolescent discrepancies.

Results

Descriptive Statistics

Table 2 summarizes the correlations, means, and standard deviations for all measures. Adolescents' and parents'

reports on adolescents' peer-related loneliness were strongly and positively correlated. Adolescents' report of parent-related loneliness was positively correlated with adolescents' reports on adolescents' peer-related loneliness, but it was not correlated with parent's reports on adolescents' peer-related loneliness. In addition, parent-related loneliness was negatively correlated with prosocial behavior and positively correlated with aggressive behavior. Adolescents' and fathers' reports on adolescent peer-related loneliness, but not mothers' reports, were related to prosocial behavior. Neither adolescents', fathers' nor mothers' reports on adolescent peer-related loneliness were correlated with aggressive behavior.

Measurement Invariance

Measurement invariance was tested to examine whether adolescents and parents interpreted the loneliness items in a similar manner. When configural invariance was tested, the model fit was not sufficient according to predetermined cut-off scores, $\chi^2(591) = 2192.11, p < .001, RMSEA = .08, CFI = .83$. Modification indices indicated that, for all informants, Item 1 should be correlated with Item 5, Item 3 with Item 4, Item 8 with Item 12, and Item 9 with Item 10. These results indicated that these items have similar content (see Table 1). The fit for the revised configural model that incorporated these error correlations was acceptable, which indicates that adolescents, fathers, and mothers used a similar framework to assess adolescents' peer-related loneliness (see Table 3).

Metric invariance was tested by constraining the factor loadings. The change in χ^2 was significant when the factor loadings of all informants, informants of the adolescent–father dyad, or informants of the adolescent–mother dyad were constrained to be equal. However, the change in RMSEA and CFI was very small ($<.01$) for the

Table 2 Means, standard deviations, and correlations of the study variables

| Variable | 1. | 2. | 3. | 4. | 5. | 6. |
|----------------------|--------|--------|------|---------|---------|------|
| 1. L-Peer adolescent | – | | | | | |
| 2. L-Peer father | .50*** | – | | | | |
| 3. L-Peer Mother | .53*** | .63*** | – | | | |
| 4. L-Parent | .10* | .02 | .05 | – | | |
| 5. Prosocial Beh | –.15** | –.17** | –.09 | –.19*** | – | |
| 6. Aggressive Beh. | .05 | –.01 | .01 | .29*** | –.30*** | – |
| <i>M</i> | 1.57 | 1.67 | 3.06 | 2.95 | 3.95 | 1.52 |
| <i>SD</i> | 0.50 | 0.53 | 0.58 | 0.57 | 0.56 | 0.53 |

Note: *L-Peer* Peer-related loneliness, *L-Parent* Parent-related loneliness, *Prosocial Beh.* Prosocial Behavior, *Aggressive Beh.* Aggressive behavior

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

Table 3 Fit indices of the various measurement invariance models

| Invariance model | χ^2 | <i>df</i> | <i>RMSEA</i> ^a | <i>CFI</i> | $\Delta \chi^2$ | Δdf | <i>p</i> | ΔCFI |
|-------------------|----------|-----------|---------------------------|------------|-----------------|-------------|----------|--------------|
| Configural | | | | | | | | |
| All | 1323.45 | 576 | .06 | .923 | – | – | – | – |
| Metric | | | | | | | | |
| All | 1381.53 | 600 | .06 | .919 | 58.08 | 24 | <.001 | –.004 |
| Father-Adolescent | 1355.58 | 588 | .06 | .920 | 32.12 | 12 | .001 | –.003 |
| Mother-Adolescent | 1367.79 | 588 | .06 | .919 | 44.33 | 12 | <.001 | –.004 |
| Father-Mother | 1335.87 | 588 | .06 | .922 | 12.42 | 12 | .413 | –.001 |
| Scalar | | | | | | | | |
| All | 1538.456 | 624 | .06 | .905 | 156.93 | 24 | <.001 | –.014 |
| Father-Adolescent | 1466.03 | 600 | .06 | .910 | 110.46 | 12 | <.001 | –.010 |
| Mother-Adolescent | 1507.35 | 600 | .06 | .906 | 139.57 | 12 | <.001 | –.013 |
| Father-Mother | 1341.12 | 600 | .06 | .923 | 5.25 | 12 | .949 | –.001 |

^a Δ RMSEA are not displayed in the table as the change was always <.004

metric invariant model in comparison to the configural invariant model. Therefore, we concluded that adolescents' peer-related loneliness seemed to be metric invariant across informants. It should be noted that the factor loadings within the mother-father dyad could be constrained without significant changes in any of the fit statistics in comparison to the configural model (see Table 3).

Subsequent scalar invariance was tested by simultaneously constraining factor loadings and intercepts to be equal across informants. Both χ^2 and CFI showed a significant decrease in model fit for the scalar invariant model in comparison to the metric invariant model when all informants, informants of the adolescent–father dyad, or informants of the adolescent-mother dyad were constrained to be equal (see Table 3). In other words, we were unable to establish scalar invariance across all informants or between adolescent-parent dyads. The model fit of the scalar invariant model did not significantly worsen in comparison to the metric invariant model for the father-mother dyad. Therefore, scalar invariance was only supported for the mother-father dyad. These findings imply that, although both parents did use the same reference points to assess adolescents' peer-related loneliness, adolescents and parents did not use the same reference points. It should be noted that scalar invariance is required when comparing means, whereas metric invariance has been deemed sufficient for regression analysis (van de Schoot et al. 2012). Thereby, the lack of scalar invariance is not problematic for the subsequent discrepancy analyses, as these analyses are based on regression coefficients rather than means of the variables.

Parent-Adolescent Discrepancies

We examined how (differences between) adolescents' and parents' reports on adolescents' peer-related loneliness were

related to the various outcome variables. The results of the polynomial regression analyses are displayed in Table 4. For both adolescent-mother and adolescent-father dyads the R^2 for aggressive behavior was not significant, so no subsequent analyses were conducted for that variable. R^2 was significant parent-related loneliness, as reported by the adolescent, and prosocial behavior. The four surface test values (i.e., a_1 , a_2 , a_3 , and a_4) were examined for adolescents' parent-related loneliness and prosocial behavior. For both outcomes, the results were similar for mother-reported loneliness and father-reported loneliness.

For parent-related loneliness, the slope along the line of incongruence (a_3) was significant, but the curve (a_4) was not. This pattern of findings indicated that when adolescents reported higher levels of peer-related loneliness than their parents (i.e., when parents underestimated their child's feelings of loneliness), adolescents experienced higher parent-related loneliness (see Fig. 1). There was no evidence suggesting that peer-related loneliness was related to parent-related loneliness if parents and adolescents agreed about the level of peer-related loneliness, because the slope (a_1) and curve (a_2) along the line of perfect agreement were not significant.

For prosocial behavior, we found no significant slope (a_3) or curve (a_4) for the line of incongruence. This pattern of findings meant that we found no evidence suggesting that discrepancies between parents' and adolescents' reports on adolescents' peer-related loneliness were related to prosocial behavior. The positive a_2 indicated that there was an upward curving along the line of perfect agreement. This result indicated that when parents and adolescents agreed about the level of peer-related loneliness, prosocial behavior was highest for adolescents who experienced either very low or very high feelings of loneliness (see Fig. 2).

Table 4 Discrepancy between adolescent-reports and parent-reports on adolescents' peer-related loneliness as predictor of adolescents' parent-related loneliness, prosocial behavior and antisocial behavior

| Variable | Parent-related loneliness | | | | | | Prosocial behavior | | | | | |
|---------------------------------------|---------------------------|------|---------|---------|------|---------|--------------------|------|---------|---------|------|---------|
| | Mother | | | Father | | | Mother | | | Father | | |
| | B | SE | β | B | SE | β | B | SE | β | B | SE | β |
| Constant | 1.72*** | 0.07 | | 1.68*** | 0.08 | | 3.79*** | 0.08 | | 3.71*** | 0.08 | |
| Adolescent report (b_1) | 0.36** | 0.13 | 0.35 | 0.37** | 0.14 | 0.35 | 0.04 | 0.14 | 0.04 | 0.16 | 0.14 | 0.15 |
| Parental report (b_2) | -0.17 | 0.09 | -0.20 | -0.18 | 0.12 | -0.20 | 0.09 | 0.10 | 0.10 | -0.14 | 0.12 | -0.15 |
| Adolescent report squared (b_3) | 0.28** | 0.11 | 0.38 | 0.32** | 0.12 | 0.43 | 0.13 | 0.12 | 0.16 | 0.28* | 0.12 | 0.36 |
| Parental report squared (b_5) | 0.01 | 0.08 | 0.01 | 0.05 | 0.10 | 0.08 | 0.07 | 0.09 | 0.10 | 0.06 | 0.10 | 0.09 |
| Adolescent* Parental report (b_4) | -0.20 | 0.13 | -0.28 | -0.26 | 0.14 | -0.36 | 0.06 | 0.13 | 0.08 | -0.12 | 0.15 | -0.17 |
| R^2 | .03* | | | .04* | | | .04** | | | .06** | | |
| Adjusted R^2 | .02 | | | .02 | | | .03 | | | .04 | | |
| F | 2.3 | | | 2.45 | | | 3.28 | | | 3.64 | | |

| Variable | Aggressive behavior | | | | | |
|---------------------------------------|---------------------|------|---------|---------|------|---------|
| | Mother | | | Father | | |
| | B | SE | β | B | SE | β |
| Constant | 1.47*** | 0.07 | | 1.43*** | 0.08 | |
| Adolescent report (b_1) | -0.12 | 0.13 | -0.19 | -0.23 | 0.14 | -0.63 |
| Parental report (b_2) | 0.10 | 0.10 | 0.10 | 0.19 | 0.12 | 0.15 |
| Adolescent report squared (b_3) | -0.09 | 0.11 | -0.25 | -0.05 | 0.12 | -0.59 |
| Parental report squared (b_5) | -0.10 | 0.08 | -0.14 | 0.21 | 0.10 | -0.03 |
| Adolescent* Parental report (b_4) | -0.01 | 0.12 | 0.37 | -0.17 | 0.15 | 0.21 |
| R^2 | .01 | | | .02 | | |
| Adjusted R^2 | -0.01 | | | .00 | | |
| F | 0.66 | | | 1.21 | | |

| Variable | Aggressive behavior | | | | | |
|----------|---------------------|------|--------|-------------|------|-------|
| | Mother | | | Father | | |
| | Coefficient | SE | t | Coefficient | SE | t |
| a_1 | 0.19 | 0.12 | 1.63 | 0.19 | 0.13 | 1.41 |
| a_2 | 0.09 | 0.08 | 1.09 | 0.11 | 0.10 | 1.21 |
| a_3 | 0.53 | 0.20 | 2.67** | 0.56 | 0.22 | 2.57* |
| a_4 | 0.48 | 0.27 | 1.79 | 0.63 | 0.29 | 2.15* |

| Variable | Aggressive behavior | | | | | |
|----------|---------------------|----|---|-------------|----|---|
| | Mother | | | Father | | |
| | Coefficient | SE | t | Coefficient | SE | t |
| a_1 | - | - | - | - | - | - |
| a_2 | - | - | - | - | - | - |
| a_3 | - | - | - | - | - | - |
| a_4 | - | - | - | - | - | - |

Note: b_1 – b_5 are coefficients in the polynomial regression equation, which are used to calculate the surface test values a_1 – a_4 . Subsequently, $a_1 = (b_1 + b_2)$; $a_2 = (b_3 + b_4 + b_5)$; $a_3 = (b_1 - b_2)$; $a_4 = (b_3 - b_4 + b_5)$

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

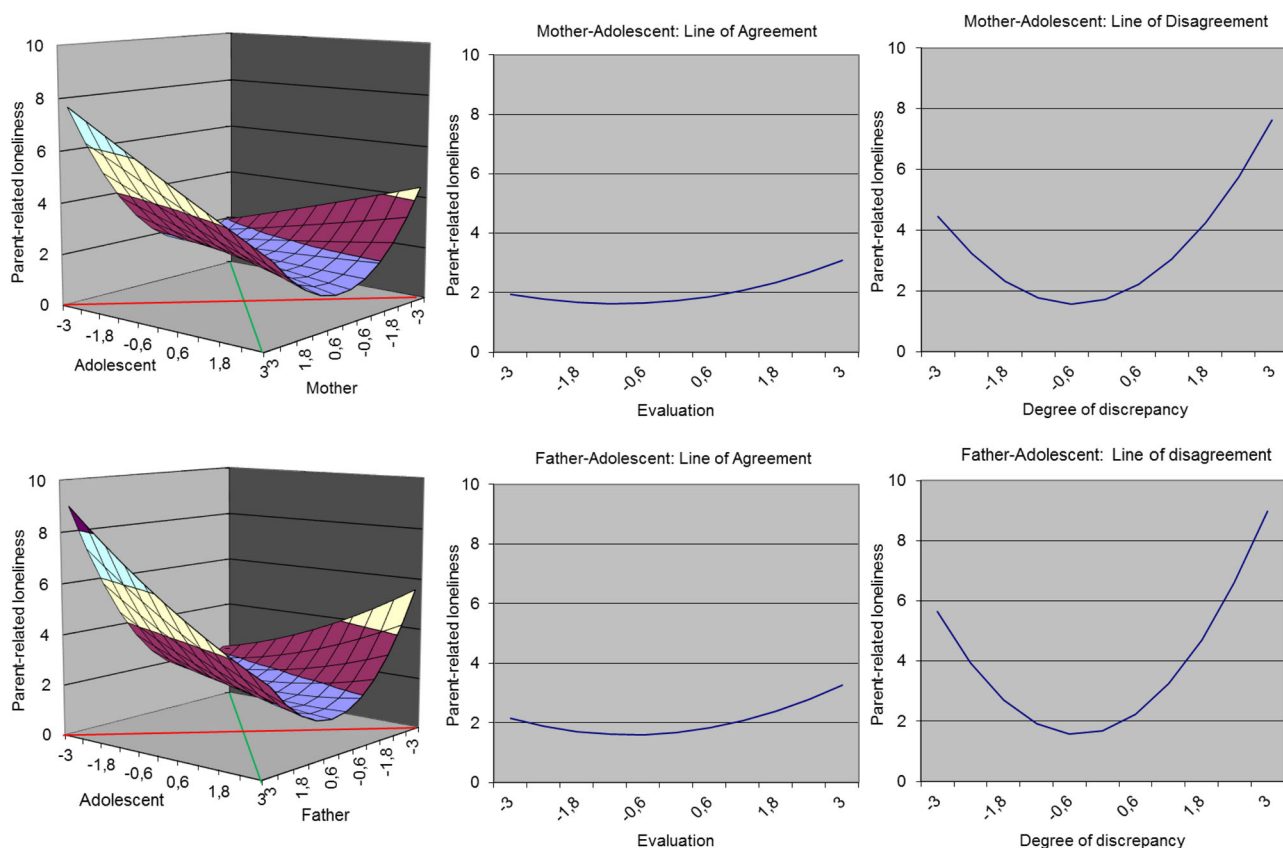


Fig. 1 Response surface models for adolescent-mother (*top*) and adolescent-father (*bottom*) discrepancies on adolescents' peer-related loneliness and its relation to parent-related loneliness. *Red line*

represents line of disagreement, *green line* represents the line of agreement (color figure online)

Discussion

Because loneliness is a subjective experience, it is often examined using self-reports (Heinrich and Gullone 2006). However, as close others can observe behavioral changes resulting from loneliness (Cacioppo et al. 2014), they could be expected to be able to report on others' loneliness. A previous study indeed indicated that reports of other informants than the self, such as parents, could be used to assess loneliness (Luhmann et al. 2016). However, it remained unclear whether the reports of different informants are comparable and what the added value is of these other-reports in addition to self-reports. In the current study, we examined the comparability of self- and parent-perspectives regarding adolescents' peer-related loneliness. In addition, we examined whether discrepancies in perspectives were related to adolescent reported parent-related loneliness, prosocial behavior, and aggressive behavior.

The current study examined the comparability between self- and other-reports and the additive value of other-reports over self-report. First, the results indicated that parents and adolescents use the same framework to conceptualize peer-related loneliness and agree on the

importance of the various indicators of peer-related loneliness. Second, adolescents experienced more self-reported parent-related loneliness when they disagreed with their parents on their peer-related loneliness. Third, when adolescents and parents were in agreement about adolescents' peer-related loneliness, both the least and the most lonely adolescents reported the highest levels of prosocial behavior. Fourth, the results provided no evidence to suggest that peer-related loneliness, as reported by adolescents, fathers, and mothers, was related to adolescents' aggressive behavior. These results suggest that the discrepancies between adolescents' and parents' reports on adolescents' peer-related loneliness might be important for adolescents' socio-emotional functioning, but not necessarily relate to adolescents' behavior.

Comparability Across Informants

We tested whether discrepancies between adolescents' and parents' reports on peer-related loneliness reflected actual differences in perspective or differences in interpretation of the questionnaire. Overall, our findings suggest that self- and other-reports on loneliness are relatively comparable.

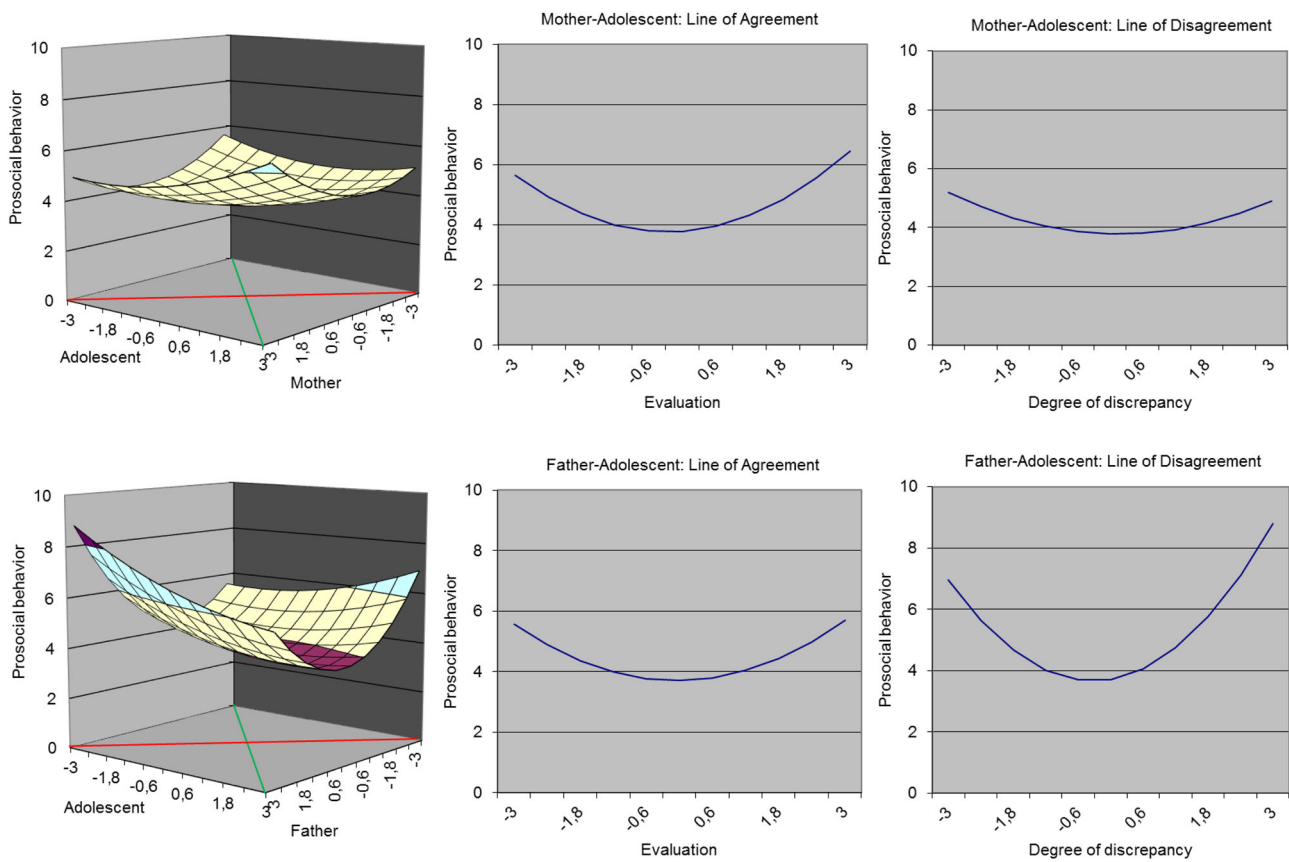


Fig. 2 Response surface models for adolescent-mother (*top*) and adolescent-father (*bottom*) discrepancies on adolescents' peer-related loneliness and its relation to prosocial behavior. *Red line* represents line of disagreement, *green line* represents the line of agreement (color figure online)

That is, our results indicated that all informants used the same conceptual framework for peer-related loneliness and similarly valued the various observable indicators (e.g., “I have/My child has fewer friends than others”) and non-observable indicators (e.g., “I feel/My child feels alone at school”) of peer-related loneliness. This finding contradicts the prevailing assumption in the literature that observable indicators are more important for parents than non-observable indicators, whereas the reverse holds for adolescents (Achenbach et al. 2005). Moreover, in line with the study by Luhmann et al. (2016), our findings suggest that self and other reports show substantial convergence.

We also found that parents and adolescents used different reference points to assess adolescents' peer-related loneliness (i.e., lack of scalar invariance), whereas fathers and mothers seem to apply the same reference points. This finding seems in line with previous research suggesting that reports of “observer informants” (i.e., fathers, mothers, and teachers) are more comparable with each other than with adolescent self-reports (e.g., De Los Reyes and Kazdin 2005). Thereby, the findings underline the notion that even though “identical” items might be used, informant reports might still not be completely comparable. Moreover, the

differences in reference points might be a reason for discrepancies between the adolescents' and parents' reports.

Informant Discrepancies and Adolescent Adjustment

This study showed that adolescents predominantly experienced parent-related loneliness when they reported higher levels of peer-related loneliness than their parents. This finding is in line with the idea that discrepancies between self and others' perceptions are related to feeling alienated from, unsupported and unaccepted by the other person (Goodman et al. 2010). Although we proposed that the discrepant views of parents and adolescents result in parent-related loneliness, the reverse could also hold true, that is, that parent-related loneliness could result in discrepant views. That is, the parent-adolescent discrepancies might arise from a reduction in communication due to the feelings of alienation. Moreover, poor relationship quality might be partially manifested in both parent-adolescent discrepancies and parent-related loneliness. Yet, poor communication, and subsequent discrepant views, are unlikely to result solely from poor relationship quality, as lonely individuals generally show decreased self-disclosure (e.g., Burke et al.

2012). An interesting avenue for future research is to examine to what extent the validity of other reports is threatened by characteristics of the relationship and characteristics of loneliness.

Although parent-adolescent discrepancies were not related to prosocial behavior, the results of this study further revealed a complex relation between loneliness and prosocial behavior. The polynomial regression results suggest that both the least and the most lonely adolescents show most prosocial behavior. Thereby, the current results are a first indication that prosocial behaviors might have a non-linear relationship with loneliness. This duality in results reflects the two opposing views in the literature. On the one hand, prosocial adolescents may be less likely to experience peer-related loneliness, because they are more likely to have favorable relationships (Eisenberg et al. 2006). On the other hand, feeling lonely motivates individuals to invest greater effort into their social relationships, by showing increased prosocial behavior (Cacioppo et al. 2006). Future research might use non-linear methods to examine the relationship between loneliness and prosocial behavior.

The current study did not provide evidence that discrepant views on peer-related loneliness was related to aggressive behavior. Although various indicators of threatened belongingness needs have been related to aggressive behavior (e.g., Leary et al. 2006), this is not necessarily true for loneliness (e.g., Mouratidis and Sideridis 2009). These findings seem to be in contrast to the idea that other perceptions discrepant of one's own perception elicit an aggressive response because it threatens the self (Swann 1990; Tracy and Robins 2003). Moreover, these findings suggest that the cognitive bias associated with loneliness does not necessarily result in aggressive behaviors, despite of the similarities with the cognitive bias of aggressive individuals (e.g., Crick and Dodge 1994). Interestingly, adolescent reported parent-related loneliness was related to aggressive behaviors. This underlines the importance of examining relationship-specific forms of loneliness, as these different forms are differentially related to adolescents' adjustment (see also Lasgaard et al. 2011; Maes et al. 2016).

Strengths and Limitations

By using polynomial regression analysis with surface modeling, this study overcomes the many shortcomings of difference or aggregated scores, such as reduction in reliability, ambiguous interpretation of results, and the unwanted mathematical constraints placed upon the data (Laird and De Los Reyes 2013). The use of both fathers' and mothers' perspectives on adolescents' loneliness represents another strength of this study. Various studies already indicated that fathers have an important but different role in the

upbringing and socialization of adolescents in comparison to mothers (Shulman and Seiffge-Krenke 2016).

Despite the above strengths, some limitations should be mentioned. First, parent-related loneliness, prosocial behavior, and antisocial behavior were only examined from the adolescents' perspective. Preferably, fathers' and mothers' perspective on these measures should also have been taken into account. Second, the generalizability of our findings might be limited. That is, the sample consisted of adolescents following the academic track in schools attended mainly by Caucasian middle class students. Although we have no compelling theoretical reason to assume that results might be different in other samples, replication in other samples is desirable. Third, we cannot draw any conclusions about the causal directions of the reported relationships. Fourth, peer-related loneliness and parent-related loneliness are, in contrast to aggressive behavior and prosocial behavior, part of the same questionnaire. Yet, a previous study showed that peer- and parent-related loneliness are distinct, but related, constructs (Maes et al. 2015a). In addition, adolescents have been found to experience peer-related loneliness without experiencing parent-related loneliness, or vice versa (Maes et al. 2016). This line of research suggest peer- and parent-related loneliness can be examined as predictors of each other.

Conclusion

The current study examined the comparability between self- and other-reports and the additive value of other-reports over self-report. Luhmann et al. (2016) were the first to suggest that other-reports regarding loneliness showed substantial convergence with self-report. The current study adds to this notion by using a different approach for showing that reports of different informants regarding loneliness are comparable. Moreover, our study suggests that discrepant views between self- and other regarding adolescents' peer-related loneliness are associated with parent-related loneliness, as reported by the adolescent, but not with aggressive or prosocial behavior. It might be interesting for future research to examine discrepancies with other informants, such as peers and romantic partners.

Authors' Contributions A.S. conceived of the study, participated in its design, performed the statistical analyses, interpreted the data, and drafted the manuscript. J.V. acquired data, was involved in concept and design of the study, participated in the interpretation of the data and critically revised the manuscript. G.L. conceived of the study, assisted with and checked the analysis, and critically revised the manuscript. P.B. conceived of the study, and critically revised the manuscript. L.G. conceived of the study, and critically revised the manuscript. All authors read and approved the final manuscript.

Conflict of Interest The authors declare that they have no competing interests.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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