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Abstract

Current theories of loneliness posit that biases in social information processing play a key role in the development and maintenance of loneliness. However, this assumption has rarely been tested in longitudinal research in adolescence. The current study concentrated on two constructs associated with such biases, that is, fear of negative evaluation and self-esteem. More specifically, we examined whether changes in loneliness were associated with simultaneous changes in fear of negative evaluation and self-esteem. A sample of Dutch adolescents (N = 1,174; 50% female) in Grades 7 to 10 completed well-established measures of loneliness, fear of negative evaluation, and self-esteem on four measurement occasions with yearly intervals. Correlations among both initial levels and rates of change for these three variables were examined using a Parallel Process Model (PPM). Adolescents scoring high on loneliness scored high on fear of negative evaluation, but low on self-esteem. Changes in loneliness were accompanied by changes in the same direction for fear of negative evaluation and in the opposite direction for self-esteem. These findings indicate that fear of negative evaluation and low self-esteem could indeed play a role in the development and maintenance of loneliness. Future research will need to clarify how exactly these variables can hamper re-affiliation efforts and lead to sustained loneliness over time.

Changes in Adolescent Loneliness and Concomitant Changes in Fear of Negative Evaluation and Self-Esteem

Loneliness is an aversive and subjective state in which people feel dissatisfied with their social relationships. They may feel that their social network is too small or may experience low relationship quality in their network when it might be sufficiently large in itself (Peplau & Perlman, 1982). Adolescents are at increased risk of experiencing loneliness, because they experience drastic changes in their social network as they distance themselves from their parents while peers gain importance (Goossens, 2018; Laursen & Hartl, 2013). Previous research on the development of loneliness found that, in general, loneliness peaks at the age of 13 and decreases afterwards throughout adolescence (Qualter et al., 2013; Van Roekel et al., 2010; Vanhalst et al., 2013a). Notwithstanding this average trend of decreasing loneliness in adolescence, various studies have found evidence for individual differences in the development of loneliness (e.g., Ladd & Ettekal, 2013; Vanhalst et al., 2013a). The evolutionary theory of loneliness, one of the leading theoretical accounts of loneliness, suggests that negative cognitions could be associated with the development of feelings of loneliness (Cacioppo & Cacioppo, 2018). However, it remains unclear which specific cognitions are associated with these developmental changes in loneliness during adolescence. This knowledge is crucial for the prevention and treatment of loneliness in adolescence.

The present study aims to enhance our current understanding of the development of loneliness in adolescence, by linking changes in loneliness to concomitant changes in constructs that are central in theoretical accounts of loneliness. These constructs are two specific cognitions, that is, fear of negative evaluation and self-esteem. Specifically, we examined whether changes over time in loneliness were accompanied by simultaneous changes in both fear of negative evaluation and self-esteem.

Evolutionary Theory of Loneliness

According to the evolutionary theory of loneliness (Cacioppo & Cacioppo, 2018), loneliness has some redeeming features. Although it is in itself a negative experience, loneliness urges us to reconnect with significant others. In other words, it has been argued that the experience of loneliness sets into motion several processes, also called the re-affiliation motive, that help people to reconnect with others and, consequently, reduce their feelings of loneliness. However, not all individuals experiencing loneliness seem to be able to reconnect and to resolve their loneliness feelings (Qualter et al., 2013). Such prolonged feelings of loneliness (i.e., when individuals fail to reconnect to others) are related to several negative physical and mental health outcomes (Heinrich & Gullone, 2006), for example depression (Qualter et al., 2010).

It has been suggested that cognitive biases, including negative interpretations of social information and self-defeating cognitions, might hamper the reconnection process (for a review see Spithoven et al., 2017). Low self-esteem and an increased fear of negative evaluation are important self-defeating cognitions that can hamper the re-affiliation motive (Qualter et al., 2015). Accordingly, in adolescence, low levels of self-acceptance and various forms of anxiety are hypothesized to represent important obstacles to successful re-affiliation (Qualter et al., 2015). However, research on this re-affiliation motive and its obstacles in adolescence is rather limited. By examining associated changes in loneliness, fear of negative evaluation, and self-esteem the present study aims to fill this gap in the literature.

First, fear of negative evaluation is the fear individuals experience to be evaluated negatively by others in social situations (Leary, 1983). Throughout adolescence, fear of negative evaluation tends to increase (Nelemans et al., 2019). Higher levels of loneliness have been associated with higher levels of fear of negative evaluation across adolescence (Cavanaugh & Buehler, 2015; Jackson, 2007; Stoeckli, 2009). When one is fearful of negative evaluation of others, one might not dare to take steps to reconnect with others and might remain lonely over time. As this fear increases, loneliness would increase as well. Conversely, when

one is not fearful of negative evaluation of others, one would be more daring to reconnect with others. However, studies on the association between loneliness and fear of negative evaluation so far did not take simultaneous changes in these constructs into account and were only cross-sectional (e.g., Cavanaugh & Buehler, 2015; Jackson, 2007; Stoeckli, 2009).

Second, self-esteem is “an individual’s subjective evaluation of her or his worth as a person” (Donnellan & Trzesniewski, 2011, p. 718). Self-esteem tends to increase from early adolescence to late adolescence (Donnellan & Trzesniewski, 2011; Orth & Robins, 2014). Self-esteem is negatively associated with loneliness in adolescence, that is, more pronounced loneliness is associated with lower self-esteem (Heinrich & Gullone, 2006; Vanhalst et al., 2013b). Moreover, this negative association between loneliness and self-esteem is bidirectional (Vanhalst et al., 2013b). When one has lower self-esteem, one might not dare to take steps to reconnect with others and might remain lonely over time. As self-esteem decreases, loneliness would increase. Conversely, when one has higher self-esteem, one might be more daring to take steps to reconnect to others. However, the study that revealed bidirectional effects looked at the predictive effect of loneliness and self-esteem on one another at a later point in time and this statistical approach (i.e., cross-lagged panel models) does not shed light on how the two constructs co-develop over time. Specifically, cross-lagged panel models do not account for intra-individual change in the constructs (Selig & Little, 2012), and consequently do not allow us to estimate whether within-person changes over time in loneliness are associated with within-person changes over time in self-esteem (i.e., slope-slope correlations).

The Present Study

The present study aimed to enhance current understanding of the development of loneliness in adolescence by examining the concomitant development of fear of negative evaluation and self-esteem. Based on the evolutionary theory of loneliness (Cacioppo & Cacioppo, 2018), we expected the development of both fear of negative evaluation and self-

esteem to be associated with the development of loneliness. We aimed to examine the correlations among loneliness, fear of negative evaluation, and self-esteem for two growth components, that is, the initial level (i.e., the intercept) and the rate of change over time (i.e., the slope).

We expected that initial levels of loneliness would be positively associated with initial levels of fear of negative evaluation (Cacioppo & Hawkley, 2009) and negatively with initial levels of self-esteem (Cacioppo & Hawkley, 2009; Vanhalst et al., 2013b). Furthermore, we expected fear of negative evaluation to develop in a similar direction as loneliness, that is, the rate of change in loneliness would be positively associated with the rate of change in fear of negative evaluation. We expected self-esteem to develop in the opposite direction compared to loneliness, that is, the rate of change in loneliness would be associated negatively with the rate of change in self-esteem. We had no specific expectations with regard to the associations between initial levels and rate of change (i.e., between intercepts and slopes) of loneliness and fear of negative evaluation. Given the bidirectional association between loneliness and self-esteem (Vanhalst et al., 2013b), we expected that higher initial levels of loneliness would be associated with decreases in self-esteem and vice versa.

Method

Participants and Procedure

Adolescents in the present study participated in the Kandinsky Longitudinal Study, a longitudinal study of the social and academic development of youth in secondary school conducted in the Netherlands (van den Berg et al., 2019). The current study focused on adolescents in 7th to 10th grade (Years 1 to 4 of Dutch secondary education) who participated in the first five waves of the study (2010-2014). This resulted in a sample of 1,173 adolescents (50.00% girls, 95.40% born in the Netherlands) from four cohorts (see Table S1 in the

supplementary material for an overview of the sample). The average age in Grade 7 was 12.71 years ($SD = 0.42$) and 15.74 years in Grade 10 ($SD = 0.48$).

This study took place in close collaboration with the school leadership and, consistent with the school policy, a passive consent procedure was adopted. Each year, parents could exclude their child from participation in the study if they so desired. Adolescents provided assent each year. This procedure was approved by the Institutional Review Board of the Faculty of Social Sciences of Radboud University (ECG2012-2505-038; “Sociometry as a Method to Measure Social Relationships Among Children and Adolescents”).

Measures

The measures used in the present study were well-established questionnaires completed by the adolescents. They were administered in Dutch, the native language of the participants.

Loneliness was measured with the peer-related loneliness subscale of the Loneliness and Aloneness Scale for Children and Adolescents (LACA; Goossens, 2016). This subscale comprised 12 items which were rated on a Likert scale ranging from 1 (*never*) to 4 (*often*). A sample item is “I feel left out by my friends”. Cronbach’s α in Grades 7 to 10 ranged between .89 and .92.

Fear of negative evaluation was measured with the 12-item Brief Fear of Negative Evaluation Scale (Leary, 1983). Items were rated on a Likert scale ranging from 1 (*does not apply to me*) to 6 (*applies to me very much*). A sample item is “I am afraid others will not approve of me”. Cronbach’s α in Grades 7 to 10 ranged between .88 and .89.

Self-esteem was measured using the 10-item Rosenberg Self-Esteem Scale (Rosenberg, 1965). Items were rated on a Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). A sample item is “On the whole, I am satisfied with myself”. Cronbach’s α in Grades 7 to 10 ranged between .87 and .89.

Statistical Analyses

The analyses were conducted in three steps. First, we tested whether the structure of the data within each cohort was sufficiently similar to combine the cohorts into one dataset. Multi-group Latent Growth Curve Models (LGCMs) were run in Mplus Version 8 (Muthén & Muthén, 1998 - 2017) using MLR estimation to test if the cohorts differed from one another. We first ran a LGCM with intercepts and slopes constrained to be equal in all cohorts. This constrained model was then compared to models with the intercept or slope for one of the cohorts estimated freely. A few of these comparisons yielded significant but small differences in intercepts and slopes ranging from 0.03 to 0.07 on a scale from 1 to 4 for loneliness and self-esteem, and on a scale from 1 to 6 for fear of negative evaluation. These differences most likely reached significance because of the large sample size, but were not considered meaningful. Therefore, we combined the cohorts in Step 2 and 3 and by means of an accelerated growth curve model. This approach leads to missing data by design, which was taken into account by using full information maximum likelihood estimation (Parker et al., 2015).

Second, we estimated three separate Latent Growth Curve Models (LGCM) using MLR estimation to model the overall trend in the development of loneliness, fear of negative evaluation, and self-esteem, respectively. In these LGCMs, mean levels of loneliness, fear of negative evaluation, and self-esteem at Grade 7 to 10 were observed indicators of two latent growth factors (i.e., the intercept and slope). An approximate Cohen's *d* effect size was calculated for the growth curves. We compared the fit of models with a linear slope to models with a quadratic slope. Following indices were used for absolute fit of the models: the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), the Comparative Fit Index (CFI), and the Satorra-Bentler chi square statistic ($S-B\chi^2$) (Satorra & Bentler, 1994). RMSEA should be below .06, SRMR should be below .08, and CFI should exceed .95 in case of good model fit (Hu & Bentler, 1999). The Chi square statistic

should preferably be as small as possible and not significant. However, as this statistic is highly sensitive to sample size (Barrett, 2007), it is important to also rely on the other previously mentioned fit indices. To compare the relative fit of the models with a linear and quadratic slope the sample size adjusted Bayesian Information Criteria (BIC) was used. A lower BIC indicated better fit of the model (Geiser, 2010).

Third, to examine how the development of loneliness was related to the development of fear of negative evaluation and self-esteem, we estimated a Parallel Process Model (PPM) using MLR estimation. In a PPM the different constructs had their own latent growth factors (i.e., intercepts and slopes). For each individual, intercepts and slopes were estimated for the three constructs. Correlations among these latent growth factors were modelled. Given that fear of negative evaluation tends to be higher for girls (Duke et al., 2006) and self-esteem tends to be lower for girls (Donnellan & Trzesniewski, 2011), we examined the role of gender. To do so, we added gender as a predictor for the latent growth factors in the PPM for each of the constructs. The same fit indices were used to evaluate the model fit of the PPM as for the LGCMs in Step 2.

Results

Descriptive Statistics

Means and standard deviations for loneliness, fear of negative evaluation, and self-esteem at each measurement occasion are presented in Table 1. Correlations among the variables across measurement occasions are presented in Table 2. These correlations were in line with previous research (Cavanaugh & Buehler, 2015; Vanhalst et al., 2013b) and were all significant. Loneliness correlated positively with fear of negative evaluation and negatively with self-esteem. Correlation coefficients decreased as the time interval between grades increased, suggesting moderate overtime stability of the constructs.

CHANGES IN ADOLESCENT LONELINESS

Table 1

Means and Standard Deviations of all Study Variables at Each Measurement Occasion

	Range	Grade 7		Grade 8		Grade 9		Grade 10	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Loneliness	1-4	1.54	0.51	1.50	0.50	1.44	0.49	1.47	0.51
Fear of Negative Evaluation	1-6	3.51	0.93	3.48	0.93	3.50	0.90	3.51	0.82
Self-Esteem	1-4	3.05	0.54	3.06	0.55	3.09	0.53	3.10	0.52

Note. Range is the range of the Likert-scale used in the questionnaires.

CHANGES IN ADOLESCENT LONELINESS

Table 2

Correlations Among the Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. LONE Grade 7	-											
2. LONE Grade 8	.51	-										
3. LONE Grade 9	.40	.49	-									
4. LONE Grade 10	.39	.49	.54	-								
5. FNE Grade 7	.46	.35	.24	.27	-							
6. FNE Grade 8	.36	.48	.33	.37	.66	-						
7. FNE Grade 9	.35	.34	.43	.37	.56	.66	-					
8. FNE Grade 10	.26	.26	.28	.43	.52	.56	.64	-				
9. SE Grade 7	-.51	-.34	-.28	-.30	-.56	-.41	-.39	-.34	-			
10. SE Grade 8	-.33	-.48	-.37	-.37	-.39	-.57	-.40	-.39	.60	-		
11. SE Grade 9	-.30	-.32	-.45	-.38	-.33	-.41	-.55	-.43	.50	.64	-	
12. SE Grade 10	-.24	-.35	-.35	-.51	-.28	-.43	-.44	-.51	.46	.60	.69	-

Note. All correlations were significant at $p < .001$. LONE = Loneliness. FNE = Fear of Negative Evaluation. SE = Self-Esteem.

Developmental Trends

In the second step of the analyses, the overall developmental trends for loneliness, fear of negative evaluation, and self-esteem were modelled in three separate LGCMs. For each of the three LGCMs, the model with the linear slope was preferred over the model with a quadratic slope, because including a quadratic slope to the LGCM led to estimation errors. The fit indices, along with the means and variances for the intercepts and slopes are presented in Table 3.

Loneliness. The fit of the LGCM with a linear slope for loneliness was good. There was a significant, but slight decrease in loneliness over time. However, the slope factor was close to zero. The variances for the intercept and slope were significant, suggesting some individual differences in both initial levels and rates of change of loneliness. An illustration of the individual developmental trends observed using spaghetti plots is presented in Figure 1, upper part.

Fear of Negative Evaluation. The fit of the LGCM with a linear slope for fear of negative evaluation was adequate. There were no significant changes in fear of negative evaluation over time, that is, the slope factor was not significant and close to zero. The variances of both the intercept and slope were significant, suggesting some individual differences in both initial levels and rate of change for fear of negative evaluation (see Figure 1, middle part).

Self-Esteem. The fit of the LGCM with a linear slope for self-esteem was good. There were no significant changes in self-esteem over time, that is, the slope factor was not significant and close to zero. The variances for both the intercept and slope were significant, suggesting some individual differences in both initial levels and rate of change for self-esteem (see Figure 1, lower part).

CHANGES IN ADOLESCENT LONELINESS

Table 3

Fit Indices and Unstandardized Means and Variances of Intercepts and Slopes for the Latent Growth Curve Models

Variable	RMSEA	SRMR	CFI	S-B χ^2	df	Intercept		Slope		d
						Mean	Variance	Mean	Variance	
Loneliness	.037	.028	.975	13.029*	5	1.54***	0.14***	-0.04***	0.01***	-0.11
Fear of Negative Evaluation	.053	.081	.979	21.773***	5	3.50***	0.59***	-0.01	0.03**	-0.01
Self-Esteem	.045	.064	.987	17.074**	5	3.05***	0.19***	0.01	0.02***	0.02

Note. BIC = sample size adjusted Bayesian Information Criterion; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; S-B χ^2 = Satorra-Bentler chi square statistic; df = degrees of freedom; d = approximate Cohen's d.

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

CHANGES IN ADOLESCENT LONELINESS

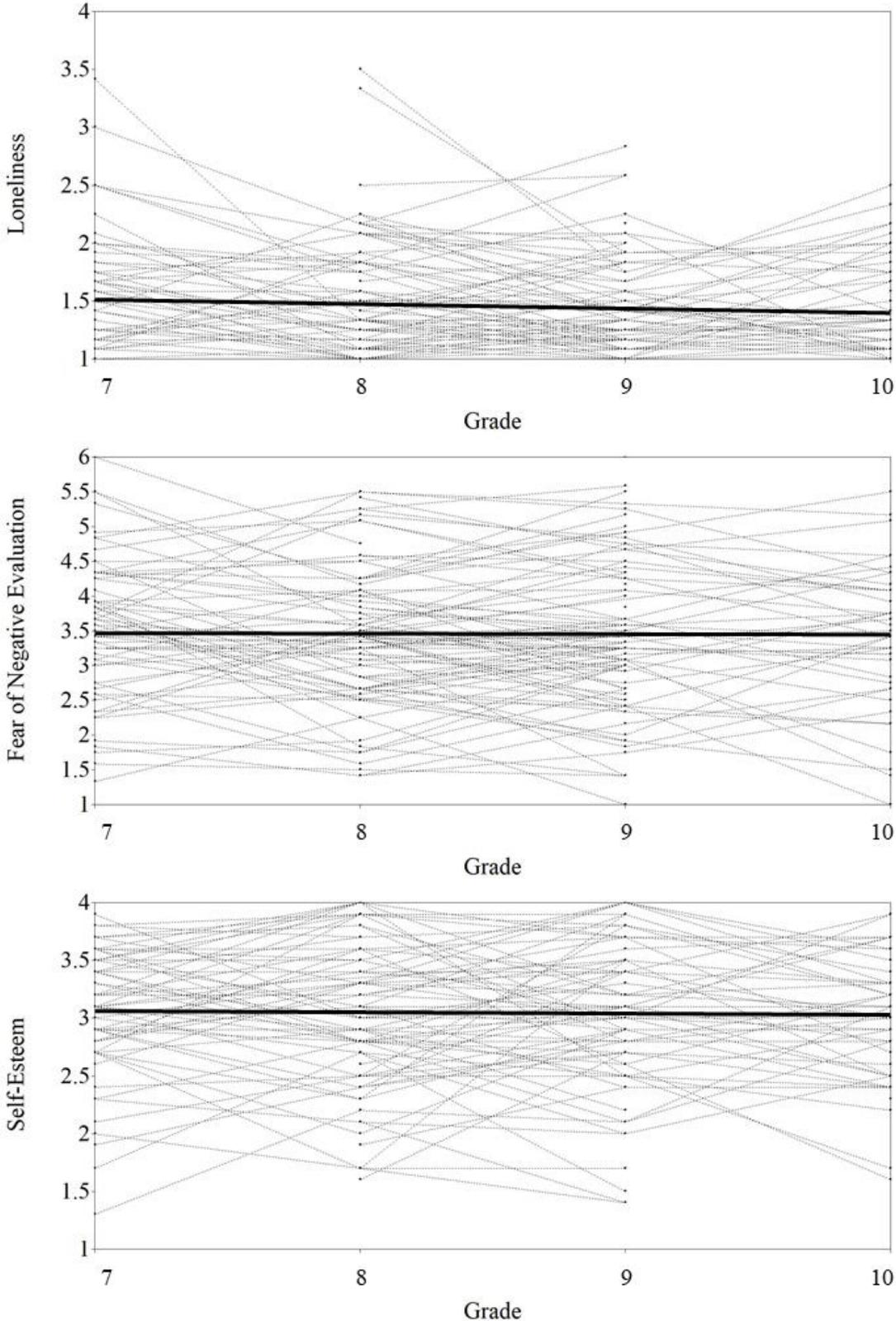


Figure 1. Longitudinal trajectory plots of adolescents’ observed longitudinal scores for loneliness, fear of negative evaluation, and self-esteem on randomly drawn subsamples comprising 100 participants of the total sample. Average trends indicated in bold.

Concomitant Development

The third step was to examine the concomitant development of loneliness, fear of negative evaluation, and self-esteem, by estimating a PPM. In the PPM, the cross-sectional correlations between the different constructs across the different measurement occasions were constrained to be equal (e.g., the correlation between loneliness Grade 7 and self-esteem Grade 7 was set to be equal to the correlation between loneliness Grade 8 and self-esteem Grade 8). The fit of the model was adequate (RMSEA = .033; SRMR = .057; CFI = .983; S-B χ^2 = 122.092, df = 54, p < .001). Gender significantly predicted the intercept of loneliness (β = .11, p < .05), fear of negative evaluation (β = .37, p < .001), and self-esteem (β = -.31, p < .001). Specifically, girls experienced higher initial levels of loneliness and fear of negative evaluation, and lower initial levels of self-esteem than boys. Additionally, gender predicted the slope of self-esteem significantly (β = -.29, p < .05) with a smaller slope for girls (M_{slope} = -.01) than for boys (M_{slope} = .03). Gender had no significant effect on the slope of loneliness (β = .09, p = .38), nor on the slope of fear of negative evaluation (β = .08, p = .36).

Table 4 presents the correlations among the latent growth factors of the PPM. The intercepts of all constructs were all significantly correlated with one another and in line with the cross-sectional correlations in Grade 7. The intercept of loneliness correlated positively with the intercept of fear of negative evaluation and negatively with the intercept of self-esteem. The intercepts of fear of negative evaluation and self-esteem were negatively correlated with one another. Specifically, the results indicate that a higher initial level of loneliness was related to a higher initial level of fear of negative evaluation and a lower initial level of self-esteem. A higher initial level of fear of negative evaluation was associated with a lower initial level of self-esteem.

All intercept-slope correlations were significant as well. The intercept of loneliness was negatively correlated with the slope of loneliness and fear of negative evaluation, and positively

with the slope of self-esteem. The intercept of fear of negative evaluation was negatively associated with the slope of loneliness and fear of negative evaluation, and positively with the slope of self-esteem. The intercept of self-esteem was associated negatively with the slope of self-esteem and positively with both the slopes of loneliness and fear of negative evaluation. Specifically, these results indicate that a higher initial level of loneliness was associated with greater decreases in loneliness and fear of negative evaluation, and greater increases in self-esteem. A higher initial level of fear of negative evaluation was associated with greater decreases in loneliness and fear of negative evaluation, and with greater increases in self-esteem. A higher initial level of self-esteem was associated with smaller decreases in loneliness and fear of negative evaluation, and with smaller increases in self-esteem.

Finally, the slopes of all constructs were all significantly correlated with one another as well. The slope of loneliness was positively associated with the slope of fear of negative evaluation and negatively with the slope of self-esteem. The slopes of fear of negative evaluation and self-esteem were negatively associated with one another. Specifically, these results indicate that increases in loneliness were associated with increases in fear of negative evaluation, and with decreases in self-esteem and vice versa. Increases in fear of negative evaluation were associated with decreases in self-esteem and vice versa. To sum up: loneliness, fear of negative evaluation, and self-esteem develop in a related way.

Table 4

Correlations Among the Latent Growth Factors of the Parallel Process Model

Variable	1.	2.	3.	4.	5.
1. I_LONE	-				
2. I_FNE	.66***	-			
3. I_SE	-.63***	-.63***	-		
4. S_LONE	-.36***	-.23*	.21*	-	
5. S_FNE	-.43**	-.43***	.31*	.61***	-
6. S_SE	.26**	.24**	-.41***	-.52**	-.51**

Note. I_LONE = intercept for loneliness. I_SE = intercept for self-esteem. I_FNE = intercept for fear of negative evaluation. S_LONE = slope for loneliness. S_SE = slope for self-esteem. S_FNE = slope for fear of negative evaluation.

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

Discussion

The current study further extended existing knowledge on individual differences in the development of loneliness, by linking the development of loneliness to the initial levels and rate of change of fear of negative evaluation and self-esteem. In line with the expectations, initial levels of loneliness were positively associated with initial levels of fear of negative evaluation. Adolescents who felt more lonely in Grade 7 were more fearful of negative evaluation. Moreover, the development of loneliness was positively associated with the development of fear of negative evaluation. Adolescents whose loneliness increased, also increased with regard of fear of negative evaluation. Additionally, when experiencing higher levels of loneliness in Grade 7, adolescents were more likely to experience less fear of negative evaluation over time. One possible interpretation of this finding can be made in light of the negative average developmental trend for fear of negative evaluation, that is, on average adolescents experience less fear of negative evaluation over time. Due to ceiling effects, adolescents who initially experienced more loneliness and thus more fear of negative evaluation (i.e., positive intercept-

intercept correlation), could decrease more in fear of negative evaluation, compared to those experiencing less loneliness and fear of negative evaluation. However, one should be aware that on average, the negative trend for fear of negative evaluation was non-significant.

Also in line with our expectations, we found that initial levels of loneliness and self-esteem were negatively associated. Adolescents who felt more lonely in Grade 7 had lower self-esteem. Moreover, the development of loneliness was negatively associated with the development of self-esteem. Adolescents whose feelings of loneliness increased, showed a decrease in self-esteem over time and vice versa. Additionally, when experiencing more loneliness in Grade 7, adolescents were more likely to increase in self-esteem over time. One possible interpretation of this finding can be made in light of the positive developmental trend of self-esteem. Due to floor effects, adolescents who initially experienced more loneliness and thus lower self-esteem (i.e., negative intercept-intercept correlation), could increase more in self-esteem compared to those experiencing less loneliness and having higher self-esteem. However, one should be aware that on average self-esteem was rather stable.

Overall, the intercepts of all three constructs were strongly related to one another. This could raise questions on the distinguishability of loneliness, fear of negative evaluation, and low self-esteem. However, previous research showed, by means of factor analyses in three distinct adolescent samples, that social anxiety and loneliness are related but distinct constructs (Danneel et al., 2019). In this study, fear of negative evaluation was included as a subscale of social anxiety. All items of the fear of negative evaluation subscale loaded substantively on the social anxiety factor, and not on the loneliness factor (Danneel et al., 2019). So, loneliness and fear of negative evaluation can be considered as separate, though strongly related, constructs. For self-esteem and loneliness, however, no such research is available. The distinctiveness of loneliness and low self-esteem could be an interesting avenue for future research.

The present study sheds light on the separate average developmental trends of loneliness, fear of negative evaluation, and self-esteem as well. The findings revealed that loneliness decreased slightly throughout adolescence, which is in line with previous research on the development of loneliness (e.g., Qualter et al., 2013). However, one study on the development of loneliness throughout adolescence found no such changes in one sample and an increasing trend in another sample (Danneel et al., 2018). Overall, the effect sizes of the developmental changes in loneliness both in the present study and in previous research are rather small. This could suggest that, throughout adolescence, loneliness remains relatively stable. A meta-analysis on the life-span development of loneliness found indeed that loneliness remained stable throughout adolescence (Mund et al., 2020). Additionally, the results indicated that fear of negative evaluation and self-esteem remained stable over time. The latter findings contradict previous research which suggests that both fear of negative evaluation and self-esteem increase throughout adolescence (Nelemans et al., 2019; Orth & Robins, 2014). For all three variables the variances of the intercepts were significant, meaning that it would be possible to identify different groups based on their mean levels of loneliness, fear of negative evaluation, and self-esteem. The variances of the slopes were close to zero, but significant. It is possible that the latter reached significance due to our large sample size, so some caution is needed when interpreting the results. The spaghetti plots (see Figure 1) show that the majority of adolescents experienced relatively stable levels of loneliness, fear of negative evaluation, and self-esteem across the four years. However, for each construct there are some adolescents who show a different developmental pattern. This could be a subtle indication that there are individual differences with regard to the developmental trends of these constructs. Future research should look into these developmental differences.

Overall, our findings are in line with the evolutionary theory of loneliness which suggests that lonely individuals are subject to negative, self-defeating cognitions (Cacioppo &

Cacioppo, 2018; Cacioppo & Hawkley, 2009). The results of the present study suggest that fear of negative evaluation and self-esteem could play a role in the development and maintenance of loneliness in adolescence and thus in the re-affiliation motive. Fear of negative evaluation and self-esteem could be obstacles on the road to successful reconnection to others during adolescence. Our findings suggest indeed that higher initial levels of loneliness are associated with more fear of negative evaluation and lower self-esteem and that these initial levels overall show little change. For instance, when fearing the negative evaluation of others or having low self-esteem the social environment is perceived as more threatening. This perceived threat in the social environment might prevent lonely individuals from taking steps to reconnect with others. In this way, the lonely adolescent can get stuck in a vicious cycle of feeling lonely and having self-defeating cognitions. However, as we did not examine whether changes in fear of negative evaluation and self-esteem were predictors or outcomes of changes in loneliness, further research is needed to understand how exactly loneliness, fear of negative evaluation, and self-esteem influence one another. Alternative statistical approaches (e.g., random-intercept cross-lagged panel analysis) could shed light on the possible role of fear of negative evaluation and self-esteem as underlying mechanisms of loneliness development. The findings also showed, in contrast to our expectations and the evolutionary theory of loneliness, that higher initial levels of loneliness were associated with decreases in fear of negative evaluation and increases in self-esteem. Hence, more research is needed to examine the co-development of loneliness, fear of negative evaluation, and self-esteem.

The co-occurrence of loneliness, fear of negative evaluation, and self-esteem as described in the present study emphasizes the role of cognitive biases in the development of loneliness. When treating loneliness, practitioners and policy makers often focus on enhancing social skills and enlarging the social network. However, as earlier work with adults already indicated, interventions focusing on cognitive biases are more effective in tackling loneliness

(Masi et al., 2011). The present study adds to the existing literature through its focus on specific types of biased social cognitions in adolescence that could hamper re-affiliation, that is, fear of negative evaluation and self-esteem. Our results suggest that lonely adolescents are more fearful of negative evaluation and have lower self-esteem, so focusing on these cognitions in interventions could perhaps alleviate feelings of loneliness. Given that changes in loneliness were associated with changes in self-esteem in the opposite direction, enhancing self-esteem among adolescents could be effective in the treatment of loneliness. Therefore, practitioners and policy makers should take fear of negative evaluation and especially self-esteem into account when developing future interventions for loneliness.

Limitations and Directions for Future Research

The current study had several strengths, including its large sample size consisting of multiple cohorts, its four-year time span, and the use of well-established measures. By considering the concomitant changes in fear of negative evaluation and self-esteem, we gained more insight in the development and maintenance of loneliness in adolescence. The current study also had some limitations that should be taken into account when interpreting the results. First, our findings are limited to correlational results and we did not gain any insight in the direction of effects. As mentioned above, we cannot determine conclusively whether fear of negative evaluation and self-esteem influence the development of loneliness.

Second, our findings are restricted to a particular period of life, that is, mid-adolescence. Adopting a life-span perspective would be instrumental in gaining a deeper understanding of the development of loneliness and its role during important life transitions. This study started right after the transition from primary school to secondary school. Two years after the end of the observation period, the participants made the transition to higher education or the workplace. Transitions like these lead to important changes in the social context of individuals.

Specifically and importantly, loneliness could further increase or decrease when entering such a new social context. It is possible that, when entering such a new social context related to these life transitions, high fear of negative evaluation and low self-esteem could prevent individuals from forming satisfactory relationships with others and therefore lead them to develop feelings of loneliness. The impact of these and other life transitions on loneliness is an important area for further research. Nevertheless, the age group we focused on in the present study is of particular importance for the development of loneliness (Qualter et al., 2015), fear of negative evaluation (Nelemans et al., 2019), and self-esteem (Orth & Robins, 2014).

Finally, our sample consisted mainly of Caucasian adolescents and all the data were collected in one secondary school in The Netherlands. This limited variation in demographic characteristics of our sample could have biased our results. Additionally, the results cannot be generalized to adolescents outside of this particular context. Future research should include adolescents with different demographical backgrounds.

Conclusion

The present study investigated the simultaneous development of loneliness and two constructs that occupy a central place in theoretical accounts of lonely feelings, that is, fear of negative evaluation and self-esteem. Higher levels of loneliness were associated with greater fear of negative evaluation and lower self-esteem. Moreover, an increase in loneliness over time was associated with an increase in fear of negative evaluation and a decrease in self-esteem. These findings are in line with the evolutionary theory of loneliness which states that fear of negative evaluation and self-esteem may play a role in the development and maintenance of loneliness in adolescence as they could hamper adolescents' efforts to reconnect to others (Cacioppo & Cacioppo, 2018).

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Supplementary Material

Table S1

Overview of Cohorts in the Sample

	Grade 7	Grade 8	Grade 9	Grade 10
Cohort 1	2010	2011	2012	2013
Cohort 2		2010	2011	2012
Cohort 3	2011	2012	2013	2014
Cohort 4	2012	2013	2014	