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## **Somatic complaints in childhood: How they are related to children's emotional and social functioning**

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### **Citation**

Jellesma, F. C. (2008, October 21). *Somatic complaints in childhood: How they are related to children's emotional and social functioning*. Retrieved from <https://hdl.handle.net/1887/13154>

Version: Not Applicable (or Unknown)

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**Note:** To cite this publication please use the final published version (if applicable).

## Chapter 5

### When I have a problem, I cannot stop thinking about it. How negative thoughts predict children's self-reported somatic complaints.

In this study, the long-term relationship between emotion regulation and children's self-reported somatic complaints was analyzed. The study included four waves with 6 months in between each wave of data collection. The sample consisted of 324 girls and 393 boys,  $M_{age}=10;3$ ,  $SD=8.5$  months at the first time of data collection. Non-'productive thoughts' (negative, repetitive thoughts about past or anticipated negative situations that reflect inadequate emotion regulation) were predictive of more self-reported somatic complaints, a relationship that was partially mediated by symptoms of depression. Of the emotion regulation strategies, particularly maladaptive cognitive strategies were associated with somatic complaints. This association, however, was fully accounted for by non-productive thoughts. The results strongly suggest that, over a period of six months, emotional problems cause an increase in self-reported somatic complaints, as reversed long-term associations were not found. In conclusion, non-productive thoughts indicate an increased risk for somatic complaints in children.

## INTRODUCTION

Somatic complaints in childhood are common, with about 25% of the children experiencing recurrent somatic complaints (Perquin, Hazebroek-Kampschreur, Hunfeld, Bohnen, van Suijlekom-Smit, Passchier et al., 2000; Petersen, Bergstrom, & Brulin, 2003; Roth-Isigkeit, Thyen, Raspe, Stoven, & Schmucker, 2004). Common complaints in childhood, such as headaches and abdominal pain, often are not (fully) explained by medical problems (Croffie, Fitzgerald, & Chong, 2000; Goodman & McGrath, 1991) and it is thought that emotional problems in addition can contribute to children's experience of somatic complaints (Eminson, 2007). Indeed, research has consistently found a positive relationship between negative emotional states and the frequency of somatic complaints. Several studies have shown a positive association between depression and somatic complaints (e.g., Campo, et al., 2004; Campo, Jansen-McWilliams, Comer, & Kelleher, 1999; Diepenmaat, van der Wal, de Vet, & Hirasig, 2006). A positive association between negative moods and somatic complaints has also been found (Jellesma, Rieffe, Meerum Terwogt, & Kneepkens 2006). This last finding suggests that emotional problems outside the ranges of psychopathology or severe negative emotional states are related to children's somatic complaints. Furthermore, it has been shown that the prevalence rates of emotional problems in children with a medical disease are similar to those found in appropriate comparison groups (Noll & Kupst, 2007; Noll, Reiter-Purtill, Vannatta, Gerhardt, & Short, 2007), whereas emotional problems do increase the symptoms of children with a disease (Rosenkranz et al., 2005; Wood et al., 2007). These findings support the assumption that emotional problems contribute to children's experience of somatic complaints. The aim of the current study was to further analyze this above described relationship between emotional problems and somatic complaints by focusing on children's emotion regulation.

One explanation for the association between emotional problems and somatic complaints comes from the perseverative cognition hypothesis (Brosschot, Gerin, & Thayer, 2006). According to this hypothesis, somatic complaints arise when physiological activation is prolonged beyond the presence of actual stressful situations. Whereas acute physiological changes in response to an actual stressor are useful in enabling a person's behavioral responses to stress (i.e. fight or flight), the prolongation of this physiological activation caused by non-productive thoughts adds to the total load that stressful events have on somatic well being (McEwen & Sapolsky, 1995). This prolonged physiological activation eventually leads to somatic complaints (Brosschot Gerin, & Thayer, 2006). Prolonged physiological activation is assumed to be caused by 'non-productive thoughts': negative, repetitive thoughts about past or anticipated negative situations that reflect inadequate emotion regulation (e.g., worry or rumination: in the adult literature referred to as 'perseverative thoughts'; Brosschot, Gerin, & Thayer, 2006; Jellesma, Meerum Terwogt, Reijntjes, Rieffe, Stegge, 2005; Verkuil, Brosschot, & Thayer, 2007). In sixteen to seventeen year old adolescents, strong support has

been found for the perseverative cognition hypothesis (Brosschot & Van der Doef, 2006). In middle childhood, however, the relationship between non-productive thoughts and somatic complaints has not yet been addressed.

Two previous studies from our research group do provide some initial support for the preservative cognition hypothesis in children. In the first study, children were presented with negative situations and asked whether they would use certain strategies aimed at reducing the associated negative emotions (e.g. learn more when nervous for a school test) and certain strategies focused on the somatic symptoms (e.g. take painkillers for a headache (Meerum Terwogt, Rieffe, Miers, Jellesma, & Tolland, 2006). It was found that compared to children with few complaints, children with many somatic complaints equally often answered confirmatively with regard to the emotion focused strategies, but more often confirmed using strategies focused on the somatic symptoms (Meerum Terwogt et al.). This indicates that even though children with many somatic complaints may be aware of possible emotion regulation strategies, they nevertheless do not expect these strategies to have a large enough reducing effect on the stress experienced to solve the somatic symptoms.

In the second study this idea was confirmed (Rieffe, Meerum Terwogt, & Jellesma, 2008). Children again were presented with negative situations, but this time we asked them how they would respond with an open question and also addressed children's expected subsequent emotion intensities. Children with many somatic complaints reported emotion regulation strategies similar to those reported by children with few somatic complaints, confirming their awareness of possible ways to reduce negative emotions. Compared to children with few somatic complaints, children with many somatic complaints in contrast expected more intense negative emotions afterwards and even later at night (Rieffe et al.). The result of this study probably reflects a less successful use of adaptive emotion regulation by children with many somatic complaints compared to peers.

These two studies suggest that non-productive thoughts are present in children with many somatic complaints (especially given the finding that they reported still having relatively intense negative emotions at night), but these thoughts were not directly assessed. Another restriction of these studies was that they mainly provided information about active emotion regulation strategies and not about the content of children's helpful or unhelpful cognitions. Comparing self-reported emotion regulation strategies of children with chronic abdominal pain and well children, Walker, Smith, and Garber (2007) found that children with abdominal pain had similar reports on active coping, but used fewer helpful thoughts. These helpful thoughts were not further specified as is usually done (e.g., putting something into perspective or positive refocussing; Garnefski, Rieffe, Jellesma, Meerum Terwogt, & Kraaij, 2007) and maladaptive cognitive emotion regulation strategies, such as self-blame, were not addressed. Thus, the studies conducted in the past have not provided very specific information about emotion regulation strategies associated with children's somatic complaints, but suggest that problems

in emotion regulation are associated with cognitions and/or ineffective use of active emotion regulation strategies.

Whereas there is a lack of information about specific emotion regulation strategies, based on the perseverative cognition hypothesis the mere presence of non-productive thoughts is expected to be of direct relevance with respect to somatic complaints. The specific content of thoughts about negative situations, although obviously associated with the presence of non-productive thoughts (Garnefski et al., 2007), is not assumed to be associated with the frequency of somatic complaints once the presence of non-productive thoughts is controlled for. After all, it is the reoccurrence of negative thoughts that is assumed to cause prolongation of physiological activation (Brosschot, Gerin, & Thayer, 2006).

The main aim of the current study was to verify whether non-productive thoughts precede somatic complaints in children. We controlled whether this relationship was not fully mediated by symptoms of depression (based on the previous finding that somatic complaints are related to emotional problems within normal ranges; Jellesma et al., 2006). Further, we also controlled for the use of specific emotion regulation strategies and expected that these strategies would not be associated with somatic complaints once non-productive thoughts were taken into account.

## **METHOD**

### PARTICIPANTS AND PROCEDURE

The study design of this study consisted of four waves (Time 1, Time2, Time3, Time4), with 6 months in between each wave of data collection. In the first wave of the study (Time 1), 717 children from 11 primary schools participated (90% response rate): 324 girls and 393 boys with a mean age of 10 years and 3 months,  $SD = 8.5$  months. There was 4% participant loss during the 1.5 years, due to children changing to schools not participating in the study. Written parental consent was obtained from all children before the conduct of the study. The children filled out questionnaires during regular school hours in their own classroom.

### MEASUREMENTS

#### **Somatic Complaints**

For the measurement of Somatic Complaints, the Somatic Complaint List was used (Jellesma, Rieffe, Meerum Terwogt, 2007). This questionnaire contains 11 items. Children indicated how often they experienced the somatic complaints in the four weeks before assessment on a five-point scale from (*almost*) *never* (0) to (*almost*) *always* (4). The scale internal reliability previously reported was good ( $\alpha = .77$ ) as was the internal consistency we found in the current study ( $\alpha = .83$ ).

#### **Measurement of Emotion Regulation Strategies**

We assessed cognitive emotion regulation strategies using the child version of the Cognitive Emotion Regulation Questionnaire (Garnefski et al., 2007). This

questionnaire consists of 9 subscales, each of which is represented by 4 items on a five point scale from (*almost*) *never* (0) to (*almost*) *always* (4). The subscales were: Selfblame, referring to thoughts of putting the blame of what you have experienced on yourself; Other-blame, referring to thoughts of putting the blame of what you have experienced on others; Acceptance (thoughts of accepting what you have experienced and resigning yourself to what has happened); Planning (thinking about what steps to take and how to handle the negative event); Positive Refocusing, (thinking about joyful and pleasant issues instead of thinking about the actual event); Focus on thought (thinking about the feelings and thoughts associated with the negative event); Positive reappraisal (thoughts of attaching a positive meaning to the event in terms of personal growth); Putting into perspective (thoughts of playing down the seriousness of the event or emphasizing the relativity when comparing it to other events); and Catastrophizing (thoughts of explicitly emphasizing the terror of an experience). Originally, Focus on thought was referred to as Rumination. However, the scale is not about the content of the thoughts and to avoid confusion with non-productive thoughts, that clearly have a negative content, we choose to use Focus on thought.

We added the Active coping subscale of the COPE in order to assess the taking of active steps to try to remove or circumvent the stressor or to ameliorate its effects (Carver, Scheier, & Weintraub, 1989) The scales are known to have sufficient internal consistencies, which was confirmed in this study (internal consistencies between .67 and .80).

#### **Measurement of Non-Productive Thoughts**

Non-productive thoughts were assessed with the Non-Productive Thoughts Questionnaire for Children (Jellesma, Meerum Terwogt, Reijntjes, Rieffe, Stegge, 2005). This scale consist of 10 statements. The child indicates whether the statements are *not true* (0), *sometimes true* (1) or *often true* (2). The statements reflect thoughts typical for rumination or worry, such as “If I have a problem, I cannot stop thinking about it” and “If I don’t exactly know what is going on, I often think something bad is going to happen”. The internal consistency of the scale is known to be good, which was confirmed in this study ( $\alpha = .84$ ).

#### **Measurement of Depression**

The Children’s Depression Inventory was used for assessing symptoms of depression (Kovacs, 1992) The scale consists of 27 items, however one item regarding suicidal ideation was dropped in this study. In each item, the children choose on of three statements, that are given a score from 0 (not reflecting a symptom of depression) to 2 (fitting a symptom of depression). The questionnaire is known to have a good internal consistency, which was confirmed in this study ( $\alpha = .81$ ).

#### STATISTICAL ANALYSIS

We analyzed the relationships between non-productive thoughts, symptoms of depression, emotion regulation strategies, and somatic complaints with Pearson product-moment correlations. Linear regression was used to confirm that emotion

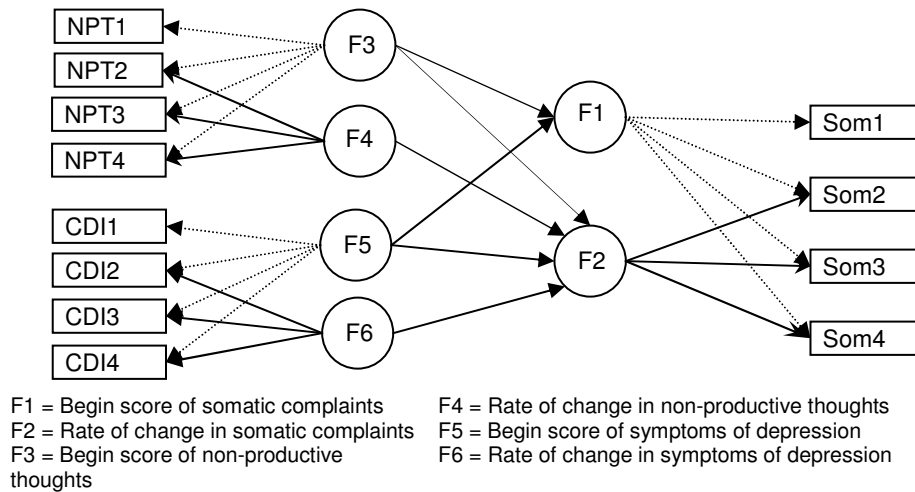
regulation strategies were no longer associated with somatic complaints once non-productive thoughts were controlled for. With the method of Baron and Kenney (1986) we tested mediation of the association between non-productive thoughts and somatic complaints by depression. The amount of mediation was estimated with Shrout and Bolger's method (2002).

Linear regression analysis does not provide information about the direction of found associations. To determine whether non-productive thoughts precede children's somatic complaints, we used two statistical methods. First, we analyzed on a group level whether non-productive thoughts precede somatic complaints. This was done with structural equation modeling. We first focused on fitting adequate measurement models, with which we meant to represent the variables as latent variables, thereby using single indicator models. The random errors were fixed at a value of one minus the scales reliability and the factor loading were fixed at the square root of the reliability. Thus without making a model with too many predictors for the latent variables, we made use of the information about our constructs provided by the questionnaire items, while taking into account the internal consistency (Bollen, 1989). Subsequently, a series of structural models were tested on the first two waves of data collection. We applied maximum likelihood estimation, using EQS 6.1 software. For evaluation of model fit, we looked at several comparative fit indices: the General Fit Index (GFI), the Normed Fit Index (NFI) and the Comparative Fit Index (CFI), with scores  $> .90$  reflecting good model fit (Stevens, 2002). For comparison of models, Chi-square difference tests were calculated, using a critical value of 5%. A common method for analyzing longitudinal relationships is the comparison of models that include cross-lagged paths (i.e. paths that reflect a causal relationship between two different variables over time) with a model that includes only stabilities. However, variables can influence each other within the time interval used, in our case 6 months (Zapf, Dormann, Frese, 1996). We did not have a hypothesis about the time interval within which a certain variable should significantly affect somatic complaints. Therefore, we also fitted models with the synchronous (concurrent) paths. These are paths that reflect an association between one variable and the other at the second time of measurement, while including the time 1 covariation and paths of stability. These models were also used to confirm our assumption that symptoms of depression precede somatic complaints

Second, on an individual level, children can show different developmental trajectories (over different periods of time children can show fluctuations reflecting increase, decreases, or stability). With multilevel structural equation techniques, we analyzed how the initial scores on somatic complaints and the rate of change over time are predicted by the begin scores and rate of change in non-productive thoughts, controlling for depression. We achieved this by predicting the scores on non-productive thoughts, symptoms of depression, and somatic complaints out of two latent variables per construct: one for the begin score and one for the rate of change (see Figure1). For this analysis, all four waves of data collection were used. We made no assumptions for the rate of change. Therefore the loadings for each

occasion were allowed to vary. This means that the rate of change can be different for each occasion. The measurement error of each variable was assumed to be constant over time. Before testing the effect of the time varying predictors, it was first verified whether, indeed, there were significant interindividual differences in the rate of change on somatic complaints to be accounted for. This was achieved by testing the latent growth model for somatic complaints independently.

Figure 1. *Multilevel structural equation model for begin score and rate of change in somatic complaints*



*Note.* Dotted paths have a factor loading 1. Structural means modeling was used: the variables indicating the means belonging to the latent variables are not depicted for simplicity.

The model including all predictors of the intercept and rate of change in somatic complaints depicted in Figure 1 (i.e. associations between the latent growth models of both independent variables and the latent growth model of somatic complaints) was subsequently compared to three models. One model included no associations between the latent growth models for the independent variables and the latent growth model for somatic complaints. The other two other models included associations between the latent growth model of a single independent variable and the latent growth model of somatic complaints. In all four models, the latent growth models of the two independent variables were allowed to covary, the latent variables for begin score and rate of change of each construct were allowed to covary, and the measurement errors of each construct were assumed to be stable.



## RESULTS

### RELATIONSHIPS BETWEEN EMOTION REGULATION STRATEGIES, DEPRESSION AND SOMATIC COMPLAINTS

The correlations between the variables are presented in Table 1. Non-productive thinking and depression were strongly associated with somatic complaints measured at the same time and at Time2, 6 months later. There was a small association between the use of positive refocusing and the experience of fewer somatic complaints, that remained over time. Stronger associations existed between the experience of more somatic complaints and the use of self-blame, acceptance, focus on thought, catastrophizing, and other-blame. Many of the independent variables were intercorrelated. We did not find any gender differences in the relationships.

Table 1  
*Correlations between the variables*

	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Som1	<b>.52</b>	<b>.28</b>	<b>.23</b>	<b>.28</b>	<b>-.10</b>	.05	<b>.08</b>	<b>.08</b>	<b>.35</b>	<b>.16</b>	.02	<b>.50</b>	<b>.39</b>
2.Som2		<b>.16</b>	<b>.15</b>	<b>.17</b>	<b>-.09</b>	.01	.06	.00	<b>.23</b>	<b>.12</b>	-.04	<b>.35</b>	<b>.34</b>
3.Self-blame			<b>.42</b>	<b>.52</b>	.07	<b>.39</b>	<b>.37</b>	<b>.35</b>	<b>.50</b>	<b>.14</b>	<b>.36</b>	<b>.48</b>	<b>.25</b>
4.Acceptance				<b>.49</b>	<b>.21</b>	<b>.35</b>	<b>.42</b>	<b>.37</b>	<b>.49</b>	<b>.29</b>	<b>.31</b>	<b>.35</b>	<b>.14</b>
5.Focus on thought					<b>.16</b>	<b>.56</b>	<b>.51</b>	<b>.37</b>	<b>.55</b>	<b>.27</b>	<b>.51</b>	<b>.47</b>	<b>.17</b>
6.Positive refocusing						<b>.43</b>	<b>.43</b>	<b>.50</b>	<b>.03</b>	.04	<b>.43</b>	<b>-.15</b>	<b>-.25</b>
7.Refocus on planning							<b>.61</b>	<b>.48</b>	<b>.31</b>	<b>.17</b>	<b>.75</b>	<b>.17</b>	<b>-.07</b>
8.Positive reappraisal								<b>.56</b>	<b>.37</b>	<b>.25</b>	<b>.56</b>	<b>.13</b>	<b>.01</b>
9.Putting into perspective									<b>.27</b>	<b>.17</b>	<b>.48</b>	<b>.12</b>	<b>-.04</b>
10.Catastrophizing										<b>.38</b>	<b>.28</b>	<b>.49</b>	<b>.34</b>
11.Other-blame											<b>.16</b>	<b>.18</b>	<b>.26</b>
12.Active coping												<b>.10</b>	<b>-.12</b>
13.NPT													<b>.44</b>
14.Depression													

Correlations in bold are significant at  $\alpha = .05$ ; Som1=Somatic complaints at time 1, Som2 = Somatic complaints at time 2, NPT = Non-productive thoughts

The results of the regression analyses are presented in Table 2. The variables could explain 30% of the variance in somatic complaints at Time 1,  $F(12, 716) = 25.06$ ,  $p < .01$ . Of the variance in somatic complaints at Time2, 17% was explained,  $F(12,701) = 12.08$ ,  $p < .01$ . Clearly, only non-productive thoughts and depression were of predictive value in both analyses. As the cognitive emotion regulation strategies were specific, but related variables, we examined whether their combined effect could contribute to the prediction of somatic complaints. In order to achieve this, two additional analyses were conducted. First, it was examined whether the emotion regulation strategies together could explain part of the variance in somatic

complaints, by entering depression and non-productive thoughts in the first step, and the other cognitive emotion regulation strategies in the second. As expected, this analysis revealed that the cognitive emotion regulation strategies as a group did not increase the amount of variance in somatic complaints explained,  $F(9, 705) = 1.26, p = .26$  at Time 1 and  $F(9, 690) = 0.57, p = .82$  at Time 2.

Table 2

*Somatic complaints at time1(Som1) and time 2 (Som2) regressed on coping strategies, non-productive thinking and depression*

Variable	B		Standardized Error		$\beta$	
	Som1	Som2	Som1	Som2	Som1	Som2
Self-blame	0.00	-0.02	0.03	0.03	0.00	-0.03
Acceptance	0.03	0.02	0.03	0.03	0.03	0.03
Focus on thought	0.03	0.02	0.03	0.04	0.05	0.03
Positive refocussing	0.00	0.01	0.02	0.02	0.00	0.03
Refocus on planning	-0.04	-0.01	0.03	0.04	-0.06	-0.01
Positive reappraisal	0.00	0.04	0.03	0.03	0.00	0.06
Putting into perspective	0.02	-0.03	0.03	0.03	0.02	-0.04
Catastrophizing	0.06	0.02	0.03	0.03	0.08	0.03
Other-blame	0.01	0.01	0.03	0.03	0.01	0.01
Active coping	-0.01	-0.04	0.03	0.03	-0.02	-0.07
Non-productive thinking	0.50	0.31	0.06	0.06	0.36**	0.24**
Depression	0.52	0.58	0.11	0.11	0.19**	0.22**

\*\* $p < .01$

Second, we used the weighted mean scores of the cognitive strategies usually considered maladaptive (selfblame, focus on thought, and catastrophizing) and of the strategies considered adaptive (planning, positive refocusing, positive appraisal, and putting into perspective). The variables made a significant,  $F(2, 712) = 2.96, p = .05$ , but very small contribution to the explained variance in somatic complaints ( $R^2 < 0.01$ ).

This effect was attributable to a positive association between maladaptive emotion regulation and somatic complaints. The weighted mean scores of the cognitive emotion regulation strategies did not contribute to the long term prediction of somatic complaints,  $F(2, 697) = 0.10, p = .90$ .

When considering the effects of non-productive thinking and symptoms of depression on somatic complaints, we found that, as expected, only part of the effect of non-productive thoughts was mediated by symptoms of depression,  $z = 8.54, p < .01$ . Comparing the cross-sectional product of the effects of non-productive thoughts on symptoms of depression (.22) and symptoms of depression on somatic complaints (1.10) with the total effect of non-productive thinking on somatic complaints (.71), we found that approximately 34% of the total effect of non-productive thinking on somatic complaints was mediated by symptoms of depression.

LONG TERM, GROUP LEVEL ASSOCIATIONS BETWEEN NON-PRODUCTIVE THOUGHTS AND SOMATIC COMPLAINTS

First, we focused on the measurement model for non-productive thoughts and somatic complaints. In this model we fitted the two factor structure, allowing the same latent variable to correlate over time and the two different variables to correlate at the same time of measurement. This resulted in a good model fit, (NFI = .985, CFI = .985, GFI = .989).

The results of the structural equation models fitted are presented in Table 3.

Table 3

*Model fit and standardized solution for structural models reflecting longitudinal relationships between non-productive thoughts (NPT), and somatic complaints (Som)*

NON-PRODUCTIVE THOUGHTS AND SOMATIC COMPLAINTS	
Model	<i>r</i>
A: Null Model [ $\chi^2$ ( <i>df</i> = 3) = 94.78;NFI = .991;CFI = .991;GFI = .941]	
NPT2 = .70NPT1 + D2	.62
Som2 = .64Som1 + D1	
B: NPT→Som2 [ $\chi^2$ ( <i>df</i> = 2) = 87.80*;NFI = .991;CFI = .991 ;GFI = .944]	
NPT2 = .71NPT1 + D2	.61
Som2 = .14NPT1 + .54Som1 + D1	
C: Som→NPT2 [ $\chi^2$ ( <i>df</i> = 2) = 92.40;NFI = .991;CFI = .991;GFI = .941]	
NPT2 = .65NPT1 + .08Som1 + D2	.61
Som2 = .64NPT1 + D1	
D: NPT2→Som2 [ $\chi^2$ ( <i>df</i> = 2) = 21.69**;NFI = .998;CFI = .998;GFI = .985]	
NPT2 = .69NPT1 + D2	.59
Som2 = .36NPT2 + .46Som1 + D1	
E: Som2→NPT2 [ $\chi^2$ ( <i>df</i> = 2) = 22.77**;NFI = .998;CFI = .998;GFI = .984]	
NPT2 = .62NPT1 + .34Som1 + D2	.60
Som2 = .62Som1 + D <sub>1</sub>	

\**p* < .05, \*\**p* < .01 in comparison with Model A, *r* = time 1 correlation between non-productive thoughts and somatic complaint

We followed the order and scheme of analyses of models as presented by Zapf, Dormann and Freese (1996). The Null Model (Model A) included stabilities of non-productive thoughts and somatic complaints and a correlation at Time 1, but no lagged or synchronous paths between non-productive thoughts and somatic complaints. In each of the subsequent models, one additional path was included and these models were compared against the Null Model: in Model B, the lagged effect of non-productive thoughts on somatic complaints; in Model C, the lagged effect of somatic complaints on non-productive thoughts; in Model D, the synchronous effect of non-productive thoughts on somatic complaints; and in Model E, the synchronous effect of somatic complaints on non-productive thoughts. From the comparison of the models, it became clear that the synchronous

paths were the strongest, indicating a bidirectional association between non-productive thoughts and somatic complaints in the short run (< 6 months). In the long run however, only the effect of non-productive thoughts on somatic complaints remained present.

LONG TERM, GROUP LEVEL ASSOCIATIONS BETWEEN SYMPTOMS OF DEPRESSION AND SOMATIC COMPLAINTS

The procedure for analyzing the longitudinal relationships between depression and somatic complaints was similar to that of analyzing the longitudinal relationships between non-productive thoughts and somatic complaints. The measurement model included single indicator latent variables for depression and somatic complaints, allowing correlations between the same constructs over time and correlations between somatic complaints and depression at the same point of time.

Table 4

*Model fit and standardized solution for structural models reflecting longitudinal relationships between symptoms of depression (Dep) and somatic complaints (Som)*

SYMPTOMS OF DEPRESSION AND SOMATIC COMPLAINTS		
Model		<i>r</i>
A: Null Model [ $\chi^2$ ( <i>df</i> = 3) = 56.31;NFI = .994;CFI = .994;GFI = .963]		
Dep2 =	.77*Dep1 + D2	.50
Som2 =	.64*Som1 + D1	
B: Dep1 → Som2 [ $\chi^2$ ( <i>df</i> =2) = 35.43**; NFI = .996;CFI = .996;GFI = .976]		
Dep2 =	.78*Dep1 + D2	
Som2 =	.21* Dep1 + .53* Som1 + D1	.48
C: Som1 → Dep2 [ $\chi^2$ ( <i>df</i> =2) = 54.75;NFI = .994;CFI = .944;GFI = .963]		
Dep2 =	.74*Dep1 + .05*Som1 + D2	.49
Som2 =	.64*Som1 + D1	
D: Dep2 → Som2 [ $\chi^2$ ( <i>df</i> =2) = 5.06**;NFI = .999 ;CFI = 1.000;GFI = .996]		
Dep2 =	.76*Dep1 + D2	.47
Som2 =	.30*Dep2 + .51*Som1 + D1	
E: Som2 → Dep2 [ $\chi^2$ ( <i>df</i> = 2) = 21.92**;NFI = .998;CFI = .998;GFI = .985]		
Dep2 =	.68*Dep1 + .23*Som2 + D2	.47
Som2 =	.63*Som1 + D1	

\**p* < .05, \*\**p* < .01 in comparison with Model A, *r* = time 1 correlation between symptoms of depression and somatic complaint

This measurement model had good fit properties, NFI = .986, CFI = .986, GFI = .916. Comparison of the models (Table 4) indicated that the relationship between depression and somatic complaints was also bidirectional in the short run. Over a 6 month period, only the effect of depression on somatic complaints remained significant.

### INDIVIDUAL DIFFERENCES IN THE DEVELOPMENT OF SOMATIC COMPLAINTS

First of all, a model was fitted that included only an intercept (F1) and rate of change (F2) latent variable for the prediction of somatic complaints (the right side of Figure 1). This model had a good model fit (NFI = .977, GFI = .985, CFI = .981). Even though all factor loadings of F1 and F2 were significant, the mean of F2 ( $M = 0.003$ ) did not significantly deviate from 0. The average score of somatic complaints does not seem to change over time. The mean of F1 was significant ( $M = 1.919$ ), reflecting the average begin score on somatic complaints. Both deviations were significant ( $D1 = .268$  and  $D2 = 0.067$ ), meaning that there are interindividual differences in the begin scores and in the change of somatic complaints over time. This finding justified us for analyzing the effect of non-productive thoughts.

The results of the fitted models are presented in Table 4. It can be concluded that latent growth in somatic complaints was associated with both latent growth in non-productive thoughts and symptoms of depression. The model including all effects gave the best model fit. Compared to model 1, the drop in the chi square was huge. The drop in the deviation of F1 indicates that non-productive thoughts and symptoms of depression accounted for a large part of the differences between children in their begin scores of somatic complaints. All inter-individual differences in the rate of change were accounted for. The negative covariance in the begin scores on somatic complaints and rates of change indicated that higher initial scores were associated with a subsequent decrease in somatic complaints. Higher initial scores in non-productive thoughts were also associated with a subsequent decrease in somatic complaints, whereas the effect of begin scores in depression did not have an additional effect. Children who initially had more symptoms of depression and more non-productive thoughts also reported more somatic complaints. Increases in depression and non-productive thoughts co-occurred with the experience of more somatic complaints. The relationships found were independent of gender.

### **DISCUSSION**

The results of this study show that, in line with the perseverative cognition hypothesis, non-productive thoughts precede somatic complaints in children. As expected, this long-term association between non-productive thoughts and somatic complaints was only partly mediated by symptoms of depression. Moreover, we found that somatic complaints in contrast, were not related to long-term subsequent non-productive thoughts or symptoms of depression. This finding confirms previous results indicating that associations between emotional problems and children's somatic complaints are mainly unidirectional with emotional problems preceding somatic complaints (Noll & Kupst, 2007; Noll, Reiter-Purtill, Vannatta, Gerhardt, & Short, 2007; Rosenkranz et al., 2005; Wood et al., 2007). Finally, whereas cognitive emotion regulation strategies (especially maladaptive strategies) were associated with children's somatic complaints, non-productive thoughts fully accounted for this association and in line with previous research, no association

between active coping and somatic complaints was found (Meerum Terwogt et al., 2006; Rieffe et al., 2008; Walker et al., 2007).

The finding that adaptive cognitive emotion regulation strategies and active coping were practically unrelated to children's somatic complaints is important, as it shows that children who develop frequent somatic complaints might not have a problem with understanding possible ways of efficient coping. Instead, these children are more likely to have a low self-efficacy with regard to their emotion regulation potential and therefore are less likely to (adequately) use adaptive emotion regulation (Meerum Terwogt et al., 2006). Alternatively, or in addition, negative thoughts can also easily interfere with the success of more adequate strategies. For instance, a child who failed a school test might try to think that this experience is not just bad, but also teaches him a lesson to learn better in the future. Yet, it is very unlikely that this positive thought will be helpful in reducing his negative emotions when he also keeps thinking about his failure of the test and starts to worry about future school tests. Our finding is in line with that of previous studies, showing that whereas children with many somatic complaints have knowledge of possible positive ways of emotion regulation, they still do not expect that they will be able to diminish their negative emotions and report to still think about day-time negative events when lying in bed at night (Meerum Terwogt et al., 2006; Rieffe et al., 2008).

The effect of non-productive thoughts on somatic complaints was partially mediated by symptoms of depression. It thus seems that non-productive thoughts contribute to depression and that, in turn, depression increases the risk of experiencing somatic complaints. At the same time, non-productive thoughts also had a positive relationship with children's experiences of somatic complaints, independent of depression. This is in line with the previous finding that negative moods are also associated with more frequent somatic complaints in children (Jellesma et al., 2006). Apparently, children do not have to experience (symptoms of) an affect disorder in order to experience frequent somatic complaints. According to the perseverative cognition hypothesis it can indeed be expected that non-productive thoughts cause prolonged physiological activation leading to somatic complaints and this prolongation can be reached in the presence of negative moods without depression (Brosschot et al., 2006).

One limitation of the current study was the use of six month intervals between the assessments. This is a powerful design for measuring stronger associations and analyzing individual differences in the development of somatic complaints, yet it does not give insights into possible short term bidirectional relationships between variables. Given the finding that the contemporaneous effects were much stronger compared to the longitudinal effects, future studies could address the relationships between emotion regulation and somatic complaints in shorter time intervals, for instance using diaries. Nevertheless, the results of the current study indicate that, in line with the results of Noll and colleagues (2007), if any short term effects of somatic complaints on emotional problems are present, these effects usually dissipate over time. In other words: whereas it is possible that children do have

some emotional problems at the moment they are bothered by certain somatic complaints, these emotional problems are not long-lasting.

It may seem contra-intuitive that children with frequent somatic complaints, and even children with severe medical conditions (Noll & Kupst, 2007) do not seem to develop more emotional problems than their healthy feeling peers. After all, not feeling well physically, whether caused by emotional or medical problems, can be thought of as a stressor on its own (Robinson & Riley, 1999). The Human Evolutionary Response to Trauma/Stress (HEART) theory recently proposed by Noll and Kupst (2007) provides a possible explanation why children seemed to show hardiness when faced with somatic problems. According to this theory, children's somatic problems are indeed a stressor. But, from an evolutionary perspective, the typical reactions of children to this stressor are likely to be adaptive. Therefore, rather than emotional problems, such as feelings of hopelessness or depression, children who have been faced with somatic complaints and/or disease will show reactions such as alertness and increased attachment behavior.

These and other explanations, but also possible third variables should be given further attention. The current study was innovative in illuminating long-time associations between emotional problems and children's somatic complaints and can be used as a first step for additional studies looking into possible causal mechanisms by which common somatic complaints in childhood develop. Furthermore, the key role of non-productive thinking calls for future studies addressing further aspects of emotion regulation, such as the effectiveness of adaptive coping strategies when children simultaneously use maladaptive emotion regulation.