# Children with somatic complaints: Do they show a somatic attention bias?

The aim of this study was to investigate whether children with frequent somatic complaints have an attention bias. For this purpose, 9- to 13-year-old children participated in a dot-probe task. We compared 39 children with few/no somatic complaints with 51 children experiencing frequent complaints in their reaction times on the dot-probe task and self-reported negative moods. Children with many somatic complaints reported more negative moods and showed longer reaction times on all trials compared with children with few complaints, not only on trials that included somatic information. The longer reaction times of children with frequent somatic complaints were explained by their levels of sadness. The current study could not support the assumed somatic attention bias in children with frequent somatic complaints, but did provide some interesting new support for the emotion perspective.

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The experience of somatic complaints such as headaches, dizziness, fatigue, and abdominal pain, is widespread in children (Perquin, Hazebroek-Kampschreur, Hunfeld, Bohnen, van Suijlekom-Smit, Passchier, et al., 2000; Petersen, Bergstrom, & Brulin, 2003; Roth-Isigkeit, Thyen, Raspe, Stoven, & Schmucker, 2004). Similar to common complaints in adults, these somatic complaints in children are often not fully explained by medical conditions (Croffie, Fitzgerald, & Chong, 2000; Goodman & McGrath, 1991). Psychological explanations have therefore been suggested. These explanations focus on cognitive-perceptual factors (symptom perception approach; Hermann, Zohsel, Hohmeister, & Flor, 2008) or on emotional factors and psychophysiological activation (emotion approach; Campo et al., 2004; Gadin & Hammerstrom, 2003; Mikkelsson, Sourander, Piha, & Salminen, 1997; Murberg & Bru, 2004; Muris & Meesters, 2004; Meerum Terwogt, Rieffe, Miers, Jellesma, & Tolland, 2006). In the current study, we focused on children's attention towards somatic information. Attention is a major theme in the symptom perception approach. We also took into account the possibility that our results could be explained by an alternative, emotion approach.

The experience of somatic complaints is usually associated with physiological changes caused by, for example, a disease, emotions, or external conditions. There is, however, not a one-to-one correspondence between what happens at a physiological level and the experience of somatic complaints (Pennebaker, 1982). The extent to which physiological changes are experienced as somatic complaints depends on external information input (e.g., people will be less likely to experience somatic complaints when there is a lot of distraction from the environment). Furthermore, according to the symptom perception approach, people are not passive information recipients. They also direct their attention (Kolk et al., 2003; Rietveld & Brosschot, 1999). Some people would (voluntarily or involuntarily) give more attention to somatic experiences, further referred to as a 'somatic attention bias'. It is assumed that because of the attention given to somatic sensations, people with a somatic attention bias are more frequently aware of physiological changes. This, in turn, increases the likelihood that they will experience somatic complaints. There is some support for the relationship between a somatic attention bias and more frequent experiences of somatic complaints in adults-although these studies mainly rely on self-reports and the causal relationship is not clear (Barsky, 1992; Kolk et al., 2003; Pennebaker, 2000).

This cognitive-perceptual explanation has received little attention in the literature on childhood somatic complaints. There are two relevant studies that we wish to discuss in this respect. In a recent study by Hermann and colleagues (2008), children with recurrent abdominal pain (RAP) and a pain-free control group participated in a reaction-time experiment while they received painful (at pain threshold) or non-painful stimuli. Children's task performance (how well they performed; e.g., reaction times) and 'event-related potentials' were measured (i.e., electrical potentials recorded from the central nervous system following stimulation). The physical stimuli consisted of pressure to the hand delivered by a mechanical device. Contrary to expectations, the task performance of the children with RAP did not differ from that of the children in the control group; neither did two of the measured neurophysiological correlates of the response (the N1 and P2 event-related potentials). Compared with the controls, children with RAP only showed what is called an 'enhanced P3 component' in reaction to the painful and non-painful stimuli. This P3 component is assumed to reflect an automatic shift to somatic stimuli (Polich, 2003). Hermann et al. interpreted the difference in P3 accordingly as a general somatic attention bias, that is: children with somatic complaints would be more focused on all somatic stimuli, not just painful stimuli.

An earlier study provides an alternative explanation for the results of Hermann et al. In 2006, Boyer and colleagues also carried out an experiment in which children with RAP participated. In this study, children completed an attention bias task. Boyer et al. showed that children with RAP shifted their attention towards subliminally presented pain-related words. This would support the somatic attention bias. The same result, however, was found for social threat-related words. Possibly, the children with RAP pay more attention to all information that is negative for them, or even to all information that is personally relevant.

This last explanation would fit with findings in individuals who experience high levels of negative affect. Research from the emotion approach shows that negative affect is positively associated with somatic complaints (e.g., Campo et al., 2004; Ginsburg, Riddle, & Davies, 2006; Jellesma, 2008). Negative affect causes alterations in physiological activation (Greaves-Lord, Ferdinand, Sondeijker, Dietrich, Oldehinkel, Rosmalen, et al., 2007); i.e., fight or flight), and the prolongation of this activation can lead to a pathogenic state and somatic problems (Brosschot, Pieper, & Thayer, 2006; McEwen & Sapolsky, 1995). Several studies indicate that negative affect is associated with differences in amygdala activity. The amygdala is thought to play a key role in the processing of emotions. One recent study showed that the normal difference in amygdala activity in response to faces with fearful or neutral expressions was absent in adults with high levels of social inhibition and negative affect (De Gelder, Van de Riet, Grèzes, & Denollet, 2008). In addition, two other studies showed less differential activity in the amygdala in depressed adults compared with control subjects in response to fearful and neutral faces (Drevets, Gautier, Lowry, Bogers, Greer, & Kupfer, 2001) and similar findings were found in depressed children (Thomas et al., 2001). Perhaps, this indicates that people high on negative affect focus more on any stimulus that might be important or personally relevant. It is possible that, in comparison to their peers, children with frequent somatic complaints show different reactions on attention tasks that are explained by higher levels of negative affect. This would provide an alternative explanation to the assumed somatic attention bias and should be considered in studies attempting to measure such a bias.

In the current study, we tried to further investigate whether children with frequent somatic complaints have a somatic attention bias. More specifically, we aimed to find out whether the previously found results on experiments could be explained by (1) a somatic attention bias; (2) a bias for significant stimuli; or (3) by general distress as a result of negative affect in these children. For this purpose, we designed a dot-probe task and compared the performance of children with many or few somatic complaints. The dot-probe task is an often-used paradigm to measure selective attention (Koster, Crombez, Verschuere, & De Houwer, 2004). In this computer task participants are asked to indicate as fast as possible whether a dot appears on the left or right side of the screen. The dot is preceded by two stimuli of interest. The idea is that when children direct their attention on a certain stimulus or find it difficult to disengage from this particular stimulus, they will respond slower if the dot is placed in the position opposite to this stimulus (incongruent trial), and faster if it replaces the stimulus (congruent trial; Koster et al.). In the current study, we used pictorial stimuli preceding the dot. The stimulus of interest with respect to the somatic attention bias was a picture of what children believed to show their heart rate; the other stimulus of interest was (believed) level of classroom noise as an external stimulus. A (believed) random computer signal was used as a completely neutral stimulus. The use of heart rate and classroom noise enabled us to analyse whether differences in reaction times between the two groups could be attributed to a somatic attention bias in children with many somatic complaints or to an overall heightened attention to meaningful stimuli in children with many somatic complaints. Typically what would be expected under the symptom perception approach is that children with many somatic complaints would respond faster on the trials that were congruent on heart rate. However, if the children were more attentive to all significant stimuli, shorter reaction times on both heart rate congruent and classroom noise congruent trials could be expected for the children with many somatic complaints. We anticipated that children with frequent somatic complaints could respond slower to all trials, which would make it difficult to verify whether it was the confrontation with meaningful stimuli that slowed them down or general distress from the experiment. We therefore also used trials that included both significant stimuli. If it was the meaningfulness of the stimuli that slowed them down, a more pronounced effect would be expected on these trials; otherwise, the reaction times of the children would be on the same level as compared with the congruent/incongruent trials that contained a neutral stimulus. We analysed whether any group differences could be explained by higher levels of negative affect in children with many somatic complaints compared with children with few somatic complaints.

## Method

### Participants

We selected children aged nine and older from three regular primary schools based on the frequency with which they experienced somatic complaints. With a participation rate of 57%, our initial sample consisted of 120 children. We selected children with many and few somatic complaints (40th and 60th percentiles), based on the Somatic Complaint List (see Materials), taking into account gender differences in the mean scores ($M = 25$ for girls and $M = 19$ for boys, $t(118) = -4.55, p < .01$). Children in the group with many somatic complaints were 18 boys (somatic complaint values between 19 and 29) and 33 girls (somatic complaints values between 26 and 43). Children in the few somatic complaints group were 19 boys (somatic complaint values between 11 and 18) and 20 girls (somatic complaints values between 13 and 22). The children were in the age range of 9 to 13 (mean age = 11, $SD = 0.95$). Written parental consent was obtained for all participating children.

### Procedure

At the start of the study, parents received information letters and informed consent forms that the children took home from school. Parents were asked to return the informed consent form to their child's teacher. The questionnaires were filled out in small groups. The children were able to ask the experimenter questions at any time. The dot-probe task was presented to the children in an individual session with the experimenter. These individual sessions took place in a quiet room of the school. Debriefing took place after all participating children had finished the dot-probe task. All children confirmed that they had believed all information that was given by the experimenter during the experiment. The experimental design was submitted to the University's Ethics Commission before the start of the study.

## Materials and Design

### Somatic complaints

For the measurement of somatic complaints, the Somatic Complaint List was used (Jellesma, Rieffe, & Meerum Terwogt, 2007). This questionnaire contains 11 complaints. 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) (e.g. 'I have a headache'). The internal consistency of this questionnaire was good ($\alpha = .87$).

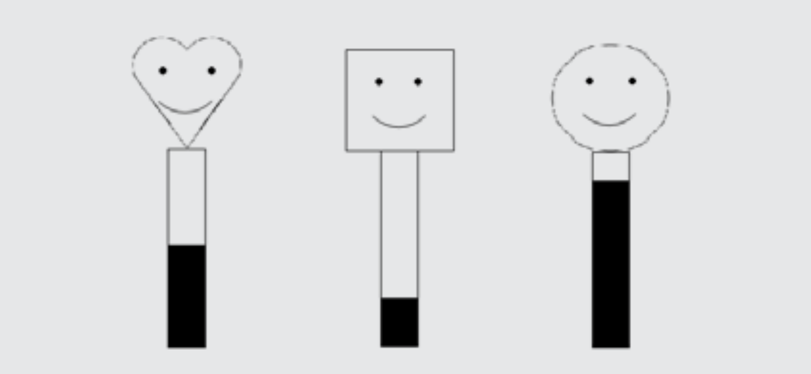
### Negative moods

The Sadness and Fear/Anxiety subscales of the Mood Questionnaire were used to assess children's self-reported negative affect (MQ; Rieffe, Oosterveld, & Meerum Terwogt, 2006). The Mood scales each consist of four items. The items are on a Likert-type scale (0 = *never*, 1 = *sometimes*, 3 = *often*, e.g. 'I never/sometimes/often feel sad'). The internal consistency of the scales were sufficient ($\alpha = .84$ for Sadness; $\alpha = .76$ for Fear/Anxiety).

### Dot-probe task

The dot-probe task was presented on a Tecra S3 Toshiba with a 15-inch monitor and was programmed in E-Prime, version 1.1. Each child was seated in a comfortable chair, approximately 70 cm from the monitor. Reaction times were recorded using a dual key button press device attached to the computer. The stimuli were pictures depicting what the children believed to be their heart rate, a neutral computer signal, or classroom noise. Figure 1 depicts examples of the pictures we used in the dot-probe task. We told the children that noise in the classroom was measured with a microphone we had put in the classroom earlier that day and that we registered their heart rate with a chip attached to the children's wrist. In order to make this story more credible, we let the children feel their own heart rate first and than attached a square band-aid from a hospital to their wrist. For the children's comfort, we told them that all ranges of heart rate were possible, and potential heart problems could not be revealed during the experiment. The neutral stimulus was said to be a random signal from the computer.

Figure 1 Examples of pictures used in the dot-probe task (from left to right): believed heart rate, computer activity (neutral), and believed classroom noise. The filling of the bars varied randomly



A trial started with a fixation cross in the middle of the screen, which was shown for 1000 milliseconds, in correspondence with previous studies using a dot-probe task in children (Joormann, Talbot, & Gotlib, 2007; Boyer et al., 2006). This was followed by two pictures on the left and right side of the screen for 1200 milliseconds (slightly shorter in comparison with a previous dot-probe study in which reading was required; Boyer et al.). The following conditions were included: *heart rate-classroom noise*, *classroom noise-heart rate*, *heart rate-neutral*, *neutral-heart rate*, *heart rate-heart rate*, *classroom noise-neutral*, *and neutral-classroom noise*. These seven conditions were randomly presented in 63 trials. After the two pictures had been shown on the screen, a black dot appeared in the centre of the place where one of the pictures had been (the left or right side of the screen). This dot remained on the screen until the child responded.

Table 1 Means and standard deviations on sadness and fear/anxiety for children with few or many somatic complaints

| Mood | Few somatic complaints M (SD) | Many somatic complaints M (SD) |
|---|---|---|
| Sadness | 0.59 (0.41) | 0.89 (0.48) |
| Fear/Anxiety | 0.59 (0.38) | 0.82 (0.47) |

Before the start of the actual experiment, children participated in a 14 trial practice session. After the practice session, the experimenter asked the child to draw how the computer shows heart rate, randomised computer signals, and classroom noise. All children had remembered this correctly. The internal consistency of all conditions was good ($\alpha >$ .80).

## Data screening

Reaction times were measured in milliseconds. Individual outliers defined as values 3 standard deviations from the individual mean, reaction times shorter than 200 milliseconds or longer than 2000 milliseconds and errors (wrong button) were deleted (less than 3% of the data). This procedure was previously suggested by Koster et al. (2004).

### Statistical analyses

Group differences in the dot-probe reaction times and in negative affect were analysed with repeated measures analyses of variance. For the dot-probe reaction times, we calculated standardised mean differences in addition to analysing potential interaction effects, by subtracting the group means and dividing by the pooled standard deviation. This was done to fully investigate the possibility that children with frequent somatic complaints would

Table 2 Reaction times in milliseconds for children with few (or no) and for children with many somatic complaints

| Condition | | Group | |
|---|---|---|---|
| In position of the dot | In position opposite to the dot | Few somatic complaints M (SD) | Many somatic complaints M (SD) |
| Heart rate | Neutral | 414.93 (75.86) | 452.43 (91.34) |
| (Heart rate congruent trial) | | | |
| Neutral | Heart rate | 417.10 (70.68) | 449.58 (82.75) |
| (Heart rate incongruent trial) | | | |
| Classroom noise | Neutral | 414.88 (70.47) | 447.56 (87.38) |
| (Classroom noise congruent trial) | | | |
| Neutral | Classroom noise | 417.50 (86.36) | 450.46 (81.95) |
| (classroom noise incongruent trial) | | | |
| Heart rate | Classroom noise | 417.19 (81.08) | 454.21 (92.02) |
| Classroom noise | Heart rate | 413.64 (69.44) | 448.23 (90.05) |
| Heart rate | Heart rate | 417.33 (65.17) | 454.21 (93.64) |

show particularly longer reaction times on trials with two meaningful stimuli. We then calculated the correlations between negative affect and reaction times. Spearman correlations were used for this purpose, because we had a sample that consisted of children who were selected on a related variable and this implies violation of normality. In order to investigate whether negative affect could explain group differences in reaction times, a repeated measure analysis of covariance was carried out, with negative affect as a covariate. Controlling for gender effects did not reveal any differences between boys and girls, therefore these results will not be presented.

## Results

### Performance on the dot-probe task

The mean reaction times for children with many somatic complaints and children with few somatic complaints are presented in Table 1. We carried out a 2(Group) x 7(Condition) analysis of variance with repeated measures on condition. We only found one effect and this was on group, $F(1,88) = 4.19$, $p = .04$. As can be seen in Table 2, children with many somatic complaints consistently responded slower than children with few somatic complaints. There was no interaction effect, $F(6,528) = 0.20$, $p = .88$. We also found that the standardised mean difference for the trials that included a neutral stimulus and for the trials that included only relevant stimuli was comparable, $SMD = 0.43$ and $SMD = 0.45$ respectively. These results indicate that the meaningfulness of the stimuli in the trials did not cause a more pronounced difference in the reaction times of the children with frequent somatic complaints.

### Negative affect

A 2(Group) x 2(Mood) analysis of variance with repeated measures on mood was carried out in order to analyse differences in negative affect between children with few and many somatic complaints. As expected, we found a main effect for Group, $F(1, 88) = 10.87$, $p < .01$. No other effects were found. Children with many somatic complaints reported more feelings of sadness and fear/anxiety than children with few somatic complaints. The means and standard deviations are shown in Table 1.

We then calculated the correlations between negative moods and children's mean reaction times. This analysis revealed that only sadness was associated with children's reaction times ($r = .27$, $p = .01$) and not fear ($r = .08$, $p = .43$).

### Sadness as an explanation for the group differences

We then carried out the same 2(Group) x 7(Condition) repeated measures analysis of variance analysis we started with, but this time included sadness as a covariate in the model. The previously found group effect on the dot-probe reaction times was no longer significant, $F(1, 87) = 2.01$, $p = .16$. This result indicates that the longer reaction times of children with many somatic complaints could be explained by their higher levels of sadness compared with the children with few somatic complaints.

## Discussion

The results of this study showed that children with frequent somatic complaints showed longer reaction times than children with few complaints on the dot-probe experiment in which they were confronted with believed heart rate and classroom noise. This result could be explained by the higher levels of negative affect in children with frequent somatic complaints: the group effect was no longer found when we controlled for sadness. The results showed that particularly sadness and not moods on the fear/anxiety dimension were associated with children's reaction times.

Our findings fail to support the somatic attention bias assumed under the symptom perception hypothesis. Furthermore, we could not find any indication of the idea that children with many somatic complaints were more focused on potentially significant information. However, the level of experienced sadness was related to children's reaction times and this gives room for explanations.

One explanation might be that children with high levels of sadness were more distracted overall by receiving information they found relevant. People who are sad (particularly people who are depressed) tend to associate negative information with negative memories and ruminate, even until after the stimulus presentation (Matt, Vazquez, & Campbell, 1992). The information the children received was ambiguous as the children had no information about what would be considered high or low and even then, both types of information can give rise to negative interpretation (e.g., low levels of classroom noise can evoke feelings of discomfort because the child thinks that he/she misses an important task whereas high levels of classroom noise could mean that the child misses a fun task). This ambiguity of information is a limitation of our study. Previous research has shown that children with high levels of sadness tend to make pessimistic attributions in ambiguous situations. As a result of distraction and rumination, sadness interferes with task performance, such as reaction times (Siegle, Steinhauer, Thase, Stenger, & Carter, 2002; Wang, Labar, & McCarthy, 2006).

Two other explanations are that children with high levels of sadness have lower reaction times either because they have less energy than their peers or because they have lower expectancies about their performance. There is a clear link in the literature between depression and fatigue and between depression and low self-worth (Lagges, & Dunn, 2003).

The children in this study were not a clinical sample, but nevertheless we could find reaction time differences. If this can be explained by one of the three above-mentioned adverse cognitive consequences of sadness, this could imply, for example, that children with frequent somatic complaints may perform at non-optimal levels in school. Somatic complaints have indeed been linked to poorer school performance (Campo, Jansen-Mcwilliams, Comer, & Kelleher, 1999). Future studies could investigate the role of sadness and rumination in this association.

A limitation of this study was that there was no information available about children's medical records. Somatic complaints in childhood are often not fully explained by medical conditions (Croffie et al., 2000; Goodman & McGrath, 1991), whereas they are strongly associated with children's emotional functioning (Jellesma et al., 2006). There nevertheless might have been children in the group with many somatic complaints whose complaints were primarily caused by medical problems. For these children, psychological processes may be less relevant. This might have resulted in an underestimation of the effects that were found.

A suggestion for future research we wish to make is the inclusion of information about children's brain activation. Future studies that include for example event-related potentials or amygdala activity might provide further insight into the underlying mechanism that explains the longer reaction times of children with many somatic complaints and the role of negative affect.

In short, in this study we could not support the hypothesis that a somatic attention bias is an explanation for somatic complaints in childhood. The study has, however, provided several new questions to be tested in future research: potential task interference caused by sadness in children with somatic complaints, interpretation biases in confrontation with ambiguous information, and differences in brain activation that may help understand why children with frequent somatic complaints seem to respond slower on reaction time experiments. If we could learn more about this, we might be able to incorporate this knowledge in treatments for these children, to prevent further life-interference related to their complaints.

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